

METAL FINISHING

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METAL FINISHING



You may have noticed the symbol above on the masthead of our publication and in other places and wondered just what it means. It stands for our membership in the Associated Business Papers, of which we are justly proud. The association includes 129 publications, serving 59 fields of business and industry. METAL FINISHING has been a member for many years, having met and maintained the high standards set for membership.

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National Metal Congress and Exposition to Be Held in Chicago, October 18-24

WITH Chicago as its 1947 meeting place, the 29th Annual National Metal Congress and Exposition will open for its first seven day session on Saturday, October 18th, continuing through Friday, October 24th.

According to *W. H. Eisenman*, managing director of the Exposition and national secretary of the American Society for Metals, sponsors of the event, approximately 375 companies and organizations will display and operate metal working equipment and products during the seven days. Exhibits will occupy all available floor space on both levels of the International Amphitheatre, an area approximating 240,000 square feet. The Exposition will open at 12 noon on October 18th and for the first five days will close nightly at 10:30 P. M. On Thursday and Friday, October 23rd and 24th, exhibits will open at 10 A. M. and close at 6 P. M. Attendance on the two opening days will be by invitation.

Mr. Eisenman stated that the early opening is planned to accommodate the unusually large number of engineers and technical people from the Chicago area before the influx of out-of-town visitors on Monday, October 20th. Approximately 20,000 persons from outside the Chicago area are expected to attend.

The National Metal Congress will again combine technical sessions of the American Society for Metals, the American Welding Society, the Iron and Steel and the Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers, and the American Industrial Radium and X-Ray Society. Thus, the eyes of the technical world of metals will be focused on Chicago.

American Society for Metals Events

In an effort to concentrate its program within manageable proportions, the American Society for Metals has limited the number of technical papers to be presented this year. On only one day (Tuesday) will two meetings be

in session simultaneously. Thus, visitors will have a better opportunity to hear all of the papers in which they may be interested. Morning sessions



A. L. Boegehold, 1947 president of ASM.

of the ASM program will be held in the Palmer House with afternoon sessions and meetings at the International Amphitheatre.

The annual meeting of the American Society for Metals will be held on Wednesday, October 22nd. Following the installation of new officers for 1948 and presentation of annual reports, the Campbell Memorial Lecture will be delivered by *Dr. A. B. Kinzel*. The Society's annual banquet will be held on Thursday evening at the Palmer House and will be featured by the award of ASM medals and honors. *Dr. Robert F. Bacher*, one of the five members of the U. S. Atomic Energy Commission, will be the principal speaker.

The Institute of Metals Division and the Iron and Steel Division of the A.I.M.E. in joint meeting will give two papers of interest to metal finishing executives. The first, which is scheduled for Tuesday, October 21st, at 2 P. M., is by *H. H. Uhlig* and is entitled "Passivity in Chromium-Iron Alloys; Absorbed Iron Films on Chromium."

The second paper, "Plating Molybdenum, Tungsten and Chromium by Thermal Decomposition of Their Carbonyls," by *J. J. Lander* and *L. H. Germer*, is scheduled for Wednesday, October 22nd. All meetings of the Society are being held at the Hotel Stevens.

Special Events

The Industrial Gas Breakfast, sponsored by the Industrial and Commercial Gas Section of the American Gas Association will be held on Wednesday morning, October 22nd, at the Stevens Hotel. The association will also sponsor a combined industrial gas exhibit at the Exposition in the International Amphitheatre. Largest single exhibit in the Show, twelve companies will be represented therein. The breakfast will be followed by the fall meeting of the Midwest Industrial Gas Council. This organization is composed of men in the industrial gas field from Illinois and neighboring states. Three or four talks will be followed by a luncheon.

The Palmer House will be the scene of this year's special alumni luncheons which will cover about twelve leading technical colleges and universities. These luncheons will be held on Wednesday, October 22nd.

The annual Canadian luncheon will be held on Thursday, October 23rd, also at the Palmer House. Six Canadian Chapters of the American Society for Metals will participate including members from Montreal, Ontario, Western Ontario, Ottawa Valley, Manitoba and British Columbia Chapters.

Metallographic Exhibit

In view of the great amount of interest shown in the first ASM Metallographic Exhibit at the convention in Atlantic City last fall, a similar display has been planned for the National Metal Exposition this year in Chicago. A prominent area has been set aside at the International Amphitheatre for display of micrographs.

The display will be sectionalized

under 11 classifications of micros, with a blue ribbon first prize in each classification. In addition a grand prize, in the form of an engrossed certificate and a money award of \$100, will go to the exhibitor whose work is adjudged "best in show."

Finishing Exhibitors

Exhibitors in the metal finishing field who will display their products at the International Amphitheatre are as follows. The list gives the supplier, products handled and personnel in attendance, wherever possible:

Acme Manufacturing Company

Automatic buffing and polishing equipment.

Aluminum Company of America

Bus bars; oxidizing process for aluminum.

Alvey-Ferguson Company

Automatic washing and cleaning equipment.

American Brass Company

Copper and brass anodes.

American Cyanamid Company

Cyanides and other chemicals.

American Wheelabrator & Equipment Corporation

Shot blasting, shot peening, automatic tumbling equipment.

In attendance: Otto A. Pfaff; L. L. Andrus; H. M. Miller; S. S. Deputy; A. E. Lenhard; M. I. Dorfan; Kenneth Barnes; John Straub.

Behr-Manning Company

Abrasives, abrasive belts.

Blakeslee & Company, G. S.

Solvent vapor degreasers and solvents.

Brown Instrument Company

Electrical and air operated control thermometers.

In attendance: L. M. Morley; W. H. Steinkamp; K. R. Knoblauch; R. R. West; J. R. Green; J. A. Robinson; C. E. Sharp; A. J. Potts; W. G. Scharing; H. W. Greisbach.

Burdett Manufacturing Company

Burn-off degreasing equipment.

Cambridge Wire Cloth Company

Industrial grades of wire cloth for

filters and all screening purposes; metal link belting.

Central Scientific Company

Laboratory equipment and supplies.

Crown Rheostat & Supply Company

Complete line of plating equipment and supplies.

Exhibiting: partially automatic plating machine; polishing machine; rheostats; cut-out reversing



F. B. Foley, 1947-8 president-elect of ASM.

switches; plating barrels, and rectifiers.

In attendance: Entire administrative and sales organization.

Detrex Corporation

Solvent vapor degreasers and solvent.

Diversey Corporation

Specialized chemicals for metal cleaning.

In attendance: B. B. Button; R. J. Stell; R. L. Shannon; A. J. Wurster; L. J. Moyes; L. C. Hesoun; C. G. Smith; J. R. Kilroy; F. C. Wagner; W. Laletin; C. F. Wentworth.

Division Lead Company

Lead tank lining and lead alloy anodes.

Finishing Publications, Inc.

Publishers of *Metal Finishing*, *Organic Finishing* and *Guidebook-Directory*.

Exhibiting: sample copies of the various publications as listed above.

In attendance: Palmer H. Langdon; Thomas A. Trumbour; Ferdinand C. Wehrman.

Note To Our Readers

Metal Industry Publishing Co., publishers of "*Metal Finishing*", has changed its name to *Finishing Publications, Inc.* The same personnel is associated with the firm and the same publishing policies will be maintained.

General Electric Company

Rectifier equipment.

B. F. Goodrich Company

Rubber linings for tanks.

W. Green Electric Company

Rectifiers and rectifier equipment.

Hammond Machinery Builders

Polishing and buffing equipment.

Exhibiting: automatic, cylindrical, single-speed and variable-speed buffing and polishing equipment; backstands for abrasive belt polishers and grinders; wet-and-dry abrasive belt grinders and polishers.

In attendance: Lee Hammond; H. J. Kingsbury; S. H. Miller; S. G. Stone; V. Shay; R. M. Bell.

Handy & Harman

Precious metal anodes.

In attendance: A. M. Setapen and sales and service engineers.

Hobart Brothers Company

Electroplating motor-generator equipment.

E. F. Houghton & Company

Metal cleaners to cover all types of cleaning; rust preventives.

International Nickel Company, Inc.

Nickel anodes; nickel plating; platinum and palladium anodes.

In attendance: Members of the Development and Research Division and members of the Nickel Sales Department.

Jackson Buff Corporation

Complete line of all types of buffs. Exhibit to be consolidated with the *Packer Machine Company*.

Exhibiting: Ventilated buffs.

In attendance: L. W. MacFarland; A. B. Stafford; P. C. Albee; E. T. Flynn.

Chas. F. L'Hommedieu & Sons

Complete line of plating equipment and supplies.

P. R. Mallory & Company

Rectifiers and rectifier equipment.



International Amphitheatre, Chicago, home of the 1947 Exposition sponsored by the American Society for Metals from October 18th through October 24th.

Manderscheid Company

Buffing and polishing equipment; polishing room accessories.

Exhibiting: polishing room accessories; two power driven polishing lathes, one single-speed and one infinitely variable-speed; backstand idlers for abrasive polishing; contact wheels for abrasive polishing.

In attendance: Carl Brockman; Leonard Pravel; H. G. Manderscheid; J. J. Manderscheid, Jr.

Metal Finishing Service

Microblast equipment and supplies for honing and finishing.

Metal Finishing Magazine

See Finishing Publications, Inc.

Metallizing Company of America

Metallic spray equipment and supplies.

Milburn Company

Skin protective creams and ointments.

Mine Safety Appliances Company

Respirators; safety clothing; first aid materials.

Ohio Carbon Company

Plating generator brushes and accessories.

Exhibiting: motor and generator commutator brushes; burnishing

tools for cleaning commutators; resistors for electronic equipment.

In attendance: F. C. Aurand; H. J. Heckel; K. A. Bartel; J. S. Owens; D. I. Stoffel; Leroy Eschner; Evert Keranen; J. E. Loudonback.

Osborn Manufacturing Company

All types of brushes.

Exhibiting: power-driven brushes; power-driven brushing wheels; maintenance brushes.

In attendance: Robert Wier, Jr.; F. T. Turner; R. O. Peterson; J. G. Gammel; W. C. LaBerge; G. E. Mehleck; R. J. Frederick; A. L. Nevers; and technical and sales engineers.

Packer Machine Company

Automatic buffing and polishing machinery. Exhibit consolidated with Jackson Buff Corporation.

Pangborn Corporation

Shot peening equipment; scale cleaning equipment; dust collectors.

Park Chemical Company

Cements for polishing wheels.

Exhibiting: polishing wheel cement.

In attendance: L. M. Harris; P. H. Kramer; A. A. Aponick; T. J. Clark; R. Hammerstein; R. N. Lynch; F. W. Reiber; J. C. Thomp-

son; M. J. Vandenberg; W. P. Woodside, Jr.

Porter-Cable Machine Company

Automatic polishing and belt sanding equipment.

Ransohoff, Inc., N.

Automatic washing and cleaning equipment; tumbling barrels.

In attendance: N. Ransohoff; John Strauss; Richard C. Wigger; William Young; Isidor Schiffrin; John Grobstein; Henry Epply; Arthur Sommers; Melville Robbins; Frank Mann and Lynn Wells.

Raybestos-Manhattan, Inc., Manhattan Rubber Division

Abrasive wheels.

Exhibiting: rubber-bonded and resinoid-bonded abrasive wheels; diamond wheels; neoprene bonded wheels.

In attendance: W. H. Steinberg; C. M. Fleming; L. S. Hilton; F. E. Tiemann; F. E. Marlowe; A. Watchorn; Owen G. Harris; E. G. Wilk.

Revere Copper & Brass, Inc.

Copper and brass anodes.

Solventol Chemical Products

Metal cleaners; rust preventives.

Exhibiting: metal cleaning, metal conditioning and rust preventative supplies.

In attendance: Jas. Rowan Ewing; J. J. Lawler; G. W. Onksen, Sr.

Torit Mfg. Company

Dust collectors.

Exhibiting: dust collectors; cloth filter and cyclone separator type equipment.

In attendance: Edward J. Girk; Donald F. Swanson; C. Sacco; E. A. Davenport; L. W. Tighe; Benjamin J. Shields.

Udylite Corporation

Complete line of plating equipment and supplies.

Exhibiting: automatic plater; horizontal barrel; air operated rinse chute; hopper machine; automatic filter; rheostat; rectifiers; barrel and cradle platers; polishing heads.

In attendance: L. K. Lindahl; C. H. Reeme; L. V. Nagle; L. J. George; J. V. Davis; Wm. Young; D. B. Stockton; T. W. Graff; W. K. Stickel; E. A. Stack.



Figure 1. Automatic buffing of die cast parts prior to plating.

Plated Zinc Base Die Castings

By E. J. Roehl, Research Laboratory, The International Nickel Company, Inc., Bayonne, N. J.

A complete resume of the most modern methods of plating zinc base die castings is here-with presented. The author explains plating specifications; casting design for plating; preparation; plating with copper-nickel, nickel direct, nickel-nickel; and chromium. This paper should bring the reader up-to-date on this important phase of metal finishing.—Ed.

DURING the past few years, the process of die casting has come to be recognized as one of the leaders among high speed production methods, and of the materials available, zinc alloys are the most widely used to the extent of about 75% of the total tonnage. Although these castings are strong, are manufactured quickly and cheaply, and require a minimum of machining and polishing, they do not polish to a high lustre. Zinc is one of the more reactive metals and as a decorative surface will not remain attractive unless it is coated with a protective layer. As the surface appearance is usually a major consideration, the castings are plated with nickel and chromium to furnish protection against corrosion and to give an enduring attractive finish.

Because of its combination of chemical and physical properties, nickel has long been used as a coating for other metals. A pore-free nickel deposit will prevent corrosion of the zinc, but in a relatively short time the nickel will become dull, and for this reason,

it is customary to apply as the final coat a thin deposit of the permanently bright and wear-resistant chromium. The bright nickel deposits will retain their lustre for a longer period of time than will the polished matte deposits, and under some circumstances, a chromium deposit is not required. Chromium deposits applied directly to the die castings without a nickel undercoat, however, yield almost no protection against corrosion.

The hot Watts nickel bath, employed for plating other basis metals, cannot be used for plating directly on zinc, as a non-adherent deposit will be obtained and the bath will become contaminated with zinc. A "high-sulfate" nickel plating bath has been developed specifically for this work. There are two general systems for plating zinc die castings—the initial or direct nickel from the high-sulfate bath and the initial copper followed by nickel. Of the two the copper-nickel is the system which for some time has been used to plate the major tonnage of the work. Entirely satisfactory, adherent deposits can be readily produced from the high-sulfate nickel bath directly on zinc, and if it is desired, an additional coat of matte or bright nickel can be added. Copper is deposited from a cyanide bath and is followed by either a matte or bright nickel. With either system, when a matte nickel is used, it is customarily buffed to obtain the full lustre of the subsequent chromium deposit. With

bright nickel only a light coloring operation may be necessary before applying chromium.

Corrosion Resistance of Nickel

The National Bureau of Standards, in cooperation with the American Electroplaters' Society and the American Society for Testing Materials, have carried out an extensive study of the atmospheric corrosion of plated zinc die castings, the results of which have been published¹. These results indicated that the most important factor in the protective value of nickel-chromium coatings on brass, steel, or zinc is the thickness of the nickel coating, that about 0.0003 in. of nickel was necessary to yield any appreciable protection and that the protection increases with the thickness, at least up to 0.002 in., which was the heaviest coating tested. Comparison of deposits produced entirely from the high-sulfate bath with those made up of two nickel layers showed no significant differences. Rather heavy deposits from the high-sulfate bath show a tendency to crack—one of the reasons for using a duplex nickel-nickel coating. Bright nickel deposits were found to be at least as protective as the matte nickel; these bright deposits showed a tendency to crack but this fault has been largely eliminated with the newer types of bright nickel. Unfortunately, there is at present no bright nickel bath for plating heavy deposits directly on zinc.

For the copper-nickel system, the data showed that with coatings of a total thickness of 0.0005 in., the copper layer furnished no added protection, that is, the results were the same as those with only the thickness of nickel that was present (0.0003 in.). With a total thickness of 0.001 in. or more, the copper layer furnished about as much protection as an equal thickness of nickel. It is necessary to have at least 0.0003 in. nickel to prevent surface copper stains on exposure and the results were poor when chromium was applied directly to the copper deposit without the intermediate nickel layer.

The data also indicated little difference in protective value between 0.00001 and 0.00003 in. of chromium over 0.0005 in. of nickel on the die castings.

A comparison of the results of the exposure tests on base metals other than zinc showed that a greater thickness of nickel is required to furnish a given degree of protection on zinc than on brass, and greater on steel than on zinc.

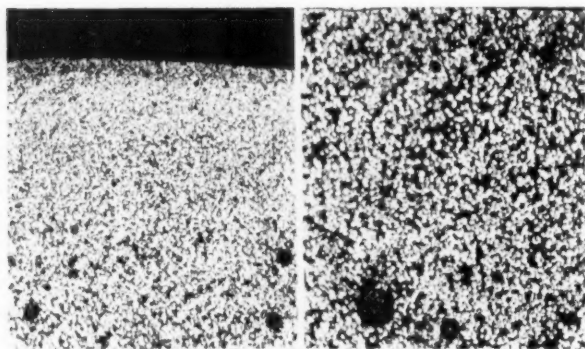


Figure 2. Structure of die castings. Left: fine, dense structure of skin. Right: coarse porous structure below skin.

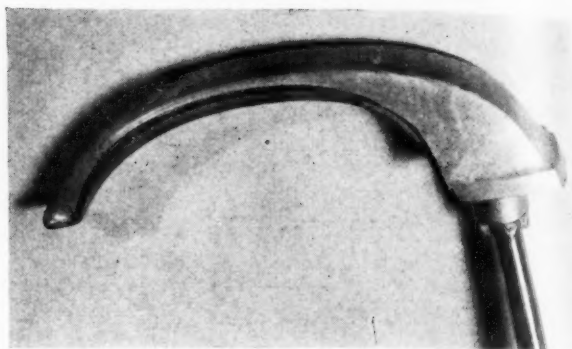


Figure 3. Die cast door handle after trimming and prior to polishing.

Specifications

The A.S.T.M. has set up the following tentative specifications for the minimum thickness of coatings on plated zinc die castings (B142-45T):

	Deposit Thickness in Inches		
	Type F.Z.	Type K.Z.	Type Q.Z.
Copper plus nickel, min.	0.00125	0.00075	0.0005
Copper, min.	0.0004	0.0003	0.0002
Final nickel, min.	0.0005	0.0003	0.0003
Chromium (if required), min.	0.00001	0.00001	0.00001
Salt Spray Test			
Hours	48	32	16

The thickness measurements are to be made by examination under a microscope and the salt spray tests by the method described under A.S.T.M. Designation: B117-44T.

Because the conditions of use are so varied, the types of service have not been assigned to these thickness specifications and any selection of deposit thickness must be based upon the experience of the manufacturers and users. Type F.Z. is designed for severe outdoor service and for example, will satisfy the requirements for exterior parts of automobiles. In the opinion of the writer, Type K.Z. would be satisfactory for all indoor and possibly some outdoor service and Type Q.Z. for most indoor uses.

Casting Design and Specification

As the first step in the plating of die castings, the original design of the part should be carefully considered. The plater is rarely consulted during the design of a casting, but it should be clear that all significant areas must be accessible for buffing and suitable for plating; other considerations of design are important, but are too lengthy for description here, and in "Designing for Die Casting"² a number of facts related to this problem have been gathered together.

Although the compositions of the castings are controlled to the extent that there are A.S.T.M. specifications to aid the manufacturer and user, through remelting of excessive numbers of rejects and for other causes compositions may be used which do not pro-

duce desirable castings from the point of view of the plater; the surface finish may not be satisfactory or the casting may be excessively porous. For plating, the most desirable attributes of a casting are: a pore-free surface, a heavy surface skin and freedom from surface blemishes. Further, significant surfaces of the casting should come from the die with as smooth a finish as possible. In die casting, the metal die chills the surface of the metal, producing a hard dense surface layer, but the center may be porous. This dense surface can be satisfactorily plated, but if it is so thin that it is cut through during polishing or if excessive polishing is necessary, the porous structure is exposed and blistering and other troubles may develop after plating.

Dimensional changes occur in castings, due to shrinkage, but it is not known how important an effect this has on the plated part.

Surface Preparation²

Although the cast parts may be produced with a smooth surface, considerable polishing and buffing are required before plating. The polishing can be done on belt sanders or glued canvas wheels or both, using abrasive grain from 50 to 250 mesh. By using soft buffs on one end of the belt, the parts and belt can conform to some degree to irregular surfaces; other belt arrangements are also used to permit grinding in recesses. Polishing is followed by buffing on soft muslin wheels to remove the polishing marks and to produce a high lustre. Both hand and automatic operations are employed and considerable ingenuity has been employed in devising fixtures.

Tumbling is employed for small parts; it requires less labor, produces an extremely smooth surface, and the plated surface compares favorably with that of wheel buffed parts. In all of the polishing and buffing operations, as little metal as possible should be removed in order to retain the dense surface skin and the work should be finished as cleanly as possible.

It has been pointed out that no plated coating can be depended upon to cover defects in the basis metal completely and that therefore, the buffing operation must be satisfactory.

Plating should follow surface preparation within a short time to prevent the formation of objectionable films.

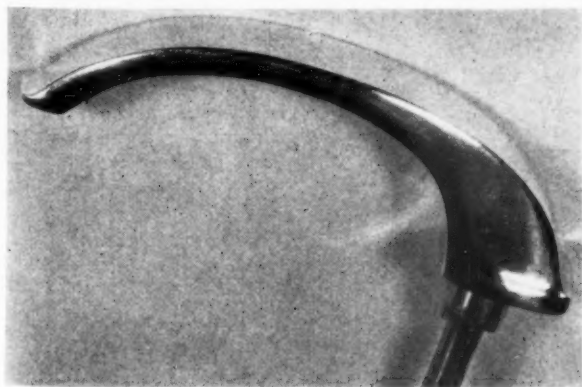


Figure 4. Die cast door handle after polishing and buffing prior to plating.

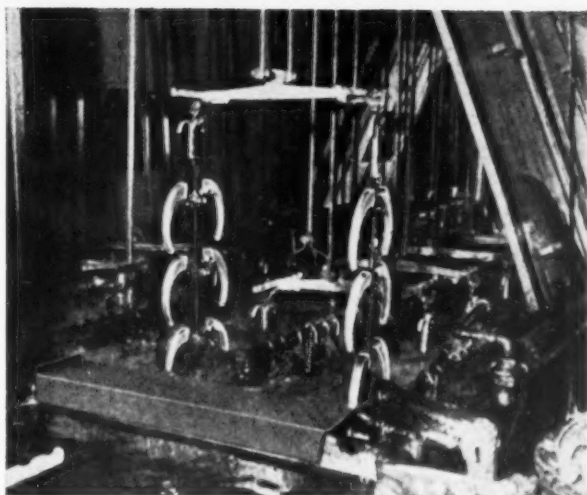


Figure 5. Parts being nickel plated in one section of an automatic plating machine.

Preparation and Plating

Cleaning: To obtain good adhesion of the deposit, the zinc surface must be thoroughly cleaned of all grease and dirt. When the parts are unusually greasy or dirty, a preliminary trichloroethylene degreasing step is included. The solvent will remove grease but grit may be left in cup-shaped recesses; this type of recess may carry out appreciable quantities of the solvent, which may be an expensive loss, but if possible the bulk of the cleaning should be done with an organic solvent as a tendency toward over alkaline cleaning can then be minimized. Hot alkaline spray cleaners have been used in place of solvents and are efficient in removing grease and grit from recessed areas. Soak and emulsion cleaners are used in conjunction with electrolytic treatments; proprietary cleaners are available on the market or a solution containing 6 ounces per gallon of trisodium phosphate may be used at temperatures of 160-180°F. The work may be treated either as anode or cathode, and also as cathode followed by anode (the cathodic treatment being 4-6 times that of the anodic). In any case, and particularly if a copper deposit is to be applied first, over-cleaning is to be avoided. As a general rule, the cleaners should be replaced regularly (possibly as often as daily) to prevent build-up of metallic contaminants which can deposit out by immersion.

Acid Dip: After water rinses the parts pass to a dilute acid dip. Over-etching in the acid dip must be avoided and the parts should be immersed in the solution only long enough for a definite gas evolution to develop. Various acid solutions have been used and the time and concentration will depend upon the type of equipment. With automatic conveyors, a 15-25 second dip in 1% sulfuric acid at room-temperature will generally give good results; the actual time of contact between acid and casting may be twice the dipping time. For hand work a 5 second dip in 5-10% hydrochloric acid can be used. A 5% sulfuric acid solution works less rapidly and is perhaps more easily controlled; weaker solutions can be used and require a longer period. A thorough rinsing should follow the acid dip.

Plating: Copper and Nickel

Since the advent of high speed bright copper plating baths, two copper baths are generally used in succession. The first is the warm conventional cyanide solution with a 1-3 minute plating period, adjusted to give the best plating conditions on low and high current density areas and to insure that no immersion plating will occur in the second copper bath. This is followed by the second bath in which at least 0.0003 inch of copper is deposited. After a thorough rinsing, the parts are given a 15-30 second dip in a 1% sulfuric acid solution, rinsed and plated in either a conventional hot Watts or a bright nickel bath.

Plating: Direct Nickel

Following the acid dip and rinse, the castings are transferred, without being allowed to dry, to a high-sulfate nickel plating bath which has been developed specifically for this type of work; the hot Watts nickel bath, employed for plating other basis metals, cannot be used for plating directly on zinc. A typical formula is:

Nickel sulfate	10-15 oz./gal.
Anhydrous sodium sulfate	10-15 oz./gal.
Ammonium chloride	2-5 oz./gal.
Boric acid	2 oz./gal.

The amount of sodium sulfate is adjusted to the complexity of shape of the articles being plated, the lower concentration being employed for simple parts, the higher values for more complicated shapes; in general, it should be as low as possible as a tendency towards cracking increases with increased sodium sulfate content.

A temperature of 70-80°F and a current density of 12-20 amperes per sq. ft. are used at the lower nickel sulfate content; at the higher content, the values employed are 75-90°F and 24-36 amps. per sq. ft. Streaking of the deposit indicates either too high a current density or the presence of impurities in the bath.

The lower content nickel sulfate bath is maintained at pH 5.3-5.7 with ammonium hydroxide or sulfuric acid; the higher content bath is operated at pH 4.9-5.4 and is maintained in this range with additions of sodium hydroxide or hydrochloric acid.

Bath Contamination

The baths should be maintained free of impurities by means of the common methods in use. When working with deeply recessed articles, it is difficult to completely cover them even with a high throwing power copper bath and if bare zinc areas remain a certain amount of zinc will dissolve and contaminate the nickel bath. A combination of analysis, Hull cell tests, and practical experience is necessary in controlling the zinc concentration. The methods for the removal of zinc—Liscomb's method (addition of ferrous sulfate and hydrogen peroxide at high pH) and the electrolytic treatment (plating on dummy cathodes at 5 amperes per sq. ft. for a total of 5 ampere hours per gallon of bath) are not too satisfactory in that they are not sufficiently practicable or economical,

but they are the only methods available and a serious attempt at prevention may be simpler than the cure. Carbonates in the nickel bath tend to produce brittle deposits and so air agitation should be avoided. The supplier should of course, be consulted for operating and purification procedures for bright baths.

Although the plated castings are generally bright enough at this point for chromium plating, some will have dull areas which require color buffing, and, in some cases, reracking will be necessary as different types of guards and shields may be necessary for the chromium plating. Following this step is an anodic or cathodic mild alkaline electrolytic cleaner, a rinse, an acid dip (15 seconds in 1% hydrofluoric or 5% sulfuric acid), another rinse, and a chromium plate.

When nickel is used as the first coating, the maximum permissible thickness is about 0.0005 inch, as heavier deposits tend to crack in service. If a heavier deposit is desired, a layer 0.0003 inch thick should be applied from the high-sulfate bath, followed by a deposit from the customary Watts type hot nickel bath. The parts should be thoroughly rinsed before the second deposit is applied and should not be allowed to dry between steps.

As yet no bath has been developed for plating bright nickel deposits directly on zinc die castings, and if the current bright baths are employed, the deposit must be applied over an initial undercoat. Where the service requires a permanently bright and wear-resistant surface, a chromium deposit is applied as the final step.

Barrel Plating

The following series of steps are typical of those used in barrel plating zinc base die castings:

- (1) Dry grind in a mixture of sawdust and powdered pumice
- (2) Alkaline cleaner
- (3) Copper plate from Rochelle salt bath at 4 amps. per sq. ft.
- (4) Ball burnish
- (5) Repeat (2)
- (6) Nickel plate
- (7) Repeat (4)

Adequate rinses are used between each step and the following conditions are used in the nickel plating:

Nickel sulfate	14-28 oz./gal.
Nickel chloride	3-6 oz./gal.
Boric acid	2 oz./gal.
Sodium borate	1 oz./gal.
Ammonium hydroxide	4-9 oz./gal.

The bath is operated at 90-140°F, pH 7-7.5, 4 amps. per sq. ft. current density.

Stripping

Chromium can be removed readily from nickel by anodic treatment at 6 volts in a solution containing six oz. per gal. of sodium hydroxide. The nickel should be color buffed, alkaline cleaned and acid dipped before being replated.

Either nickel or nickel-copper can be stripped by anodic treatment at 150° F. and 9 volts in a 50-55%

sulfuric acid solution: the acid concentration is quite critical. Nickel can be removed from zinc by a 10-30 amp. per sq. ft. anodic treatment in 2% sulfuric acid; glycerine may be added to this solution and the zinc should be reactivated in dilute acid before replating. Copper is stripped from zinc by anodic treatment at 2 volts in a solution containing one pound of sodium sulfide per gallon of water. The Stoddard method (chromic acid with alternating current) is also used.

Chromium and nickel have been stripped together by anodic treatment in 50 (41° Be) to 93% (66° Be) sulfuric acid at room temperature; glycerine can also be added to the solution.

There are a number of proprietary solutions on the market for stripping, and some of these may show greater efficiencies.

Colored lacquers are commonly used to multiply the surface appearances of plated castings, and these are baked on at temperatures up to 350°F for several hours. A standard test consists of heating the plated castings for 1/2 - 1 hour at 300-350°F, during which time no blistering should develop.

Plating Systems

Of the two general systems employed for plating zinc die castings—the initial or direct nickel and the initial copper followed by nickel—both have advantages as well as disadvantages.

The copper-nickel system is adapted for the production of heavier deposits and also appears to be the only one in use for barrel plating. The greater ability of the copper bath to plate into recesses is a distinct advantage, but it must cover completely or trouble will be encountered through zinc contamination of the subsequent nickel bath. This system must be used for complex shapes, but it is not advocated for deposits 0.0005 inch thick or less. If the zinc is over-cleaned or treated too vigorously in the acid dip, blistering may develop; however, the fundamentals of these preparatory steps are well recognized and rejects because of blistering can be kept at a low value.

The direct nickel method does not yield colored corrosion products and the advantage which zinc has in being a white metal and in giving white corrosion products is retained by restricting the plated coatings under the chromium to nickel. Nickel and zinc do not interdiffuse to form brittle alloy layers, and it is not difficult to avoid blistering with nickel. Measurement of deposit thickness is simplified when only one type of deposit is present. The maximum thickness from the high-sulfate bath commonly used in direct nickeling is about 0.0005 inch and the sodium sulfate, nickel sulfate, pH, temperature and current density must be adjusted to the complexity of shape of the articles being plated. There are also proprietary baths for plating nickel directly on zinc base alloys.

Discussion

The theory was developed some years ago that blistering, which occurred with the copper-nickel and not with the direct nickel deposit, occurred in the copper-zinc diffusion zone and was due to overcleaning of the basis metal. Electron diffraction examination of the gray material on the back of the blistered deposit and of the surface of the casting below the blister disclosed⁴ the fact that the surfaces consisted of a combination of the brittle epsilon and gamma phases, and it is assumed that these diffusion alloys form a favored source of weakness in copper-nickel coatings on zinc. The most recent work⁵ elaborates the overcleaning theory and associates it with the presence of a weak diffusion zone. If the zinc is over-cleaned in the alkaline cleaner, cavities will be formed at the aluminum-rich area, and because of too low cathodic polarization during plating in the alkaline copper bath, deposition takes place on gamma surfaces which are continually undergoing dissolution. Too long a treatment in the acid solution will overetch zinc-rich portions and develop cavities. Solution will be trapped by deposit-bridging or immersion coating, which will subsequently attack the basis metal producing gas under pressure; because of the weakness of the diffusion zone and the essentially non-adherent character of the deposit, blisters may develop during plating or at some subsequent time. The baking operation, of course, simply augments the blistering tendency.

A bath from which bright nickel could be applied directly would certainly be well received by the plating industry. Additional qualifications for an ideal direct nickel bath would be: high cathode polarization, good throwing power, high cathode efficiency, wide current density range, low susceptibility to zinc contamination and one from which deposits at least 0.001 inch thick of good mechanical properties would be deposited at high current density.

If the duplex coating must be retained, the possibility of substituting other metals for copper might be investigated: the white metals tin and cadmium, or iron from a nearly neutral bath. Although alloy plating is not too highly regarded in the industry, alloy deposits from several nickel systems might be possibilities.

References

1. Blum and Strausser: *J. Res. NBS* 24, 443 (1940).
2. New Jersey Zinc Company Pamphlet.
3. "The Finishing of Zinc Alloy Die Castings", 1938. *Research Bulletin* of the New Jersey Zinc Co.
4. Anderson and Reinhard: *Mon. Rev. A.E.S.* 27, 175 (1940).
5. Petrocelli and Phillips: *Trans. Electrochem. Soc.* 85, 257 (1944).

Electroplating Control Laboratory

Conclusion

By H. J. Sedusky and J. B. Mohler, *Research Chemists, The Cleveland Graphite Bronze Company*

Surface Tension

SURFACE tension may be controlled in a plating bath by use of a stalagmometer. This instrument is merely a bent glass tube with a small hole in the bottom. The size of the drop issuing from the hole will depend on the surface tension. The drops are allowed to form slowly and the number of drops are counted. The surface tension may be determined by the following formula:

$$\frac{\text{No. of drops for water}}{\text{No. of drops for sample}} \times \text{surface tension of water} = \text{surface tension of sample}$$

The device is rapid and of sufficient accuracy for plating work. Changes in room temperature effect the surface tension and proper correction must be made. The instrument is often calibrated directly in terms of addition agent (rather than surface tension).

If many surface tension tests are to be made, or if accuracy is required, then the du Nuoy tensiometer is a convenient and very accurate instrument.

In any surface tension test care must be taken to keep all surfaces clean and to use fresh samples for each test, since a little grease will give a false reading.

Conductivity

Electrical conductivity is often a convenient measurement for control. Cleaning and pickling baths may be rapidly analyzed by means of a conductivity

meter. The meter may also be used to measure the purity of distilled water, of boiler feed waters and of rinse waters.

Two types of meters are available. An inexpensive type contains a cathode ray tube to indicate balance. This meter is good for control work. The other type contains an alternating current galvanometer to indicate balance. This instrument is good for reliable laboratory work.

Colorimetry

Rapid analyses may be made with a photoelectric colorimeter.

The basic instrument for this type of work is the spectrophotometer. This instrument will measure the amount of light absorbed by a solution at a selected wave length. The instrument is expensive and requires a skilled operator. Not only skill but a knowledge of the science of spectrophotometry is required, so the instrument is restricted mostly to research, or highly specialized control work.

Cheaper colorimeters are practical where sufficient analyses are to be run. For instance if a great number of analyses were to be made on nickel baths, a sample is merely placed in the instrument and nickel is run directly.

The instrument is notable for its ability to detect very small amounts of elements. Traces of lead or small amounts of iron may be run rapidly as compared to the older more tedious methods.

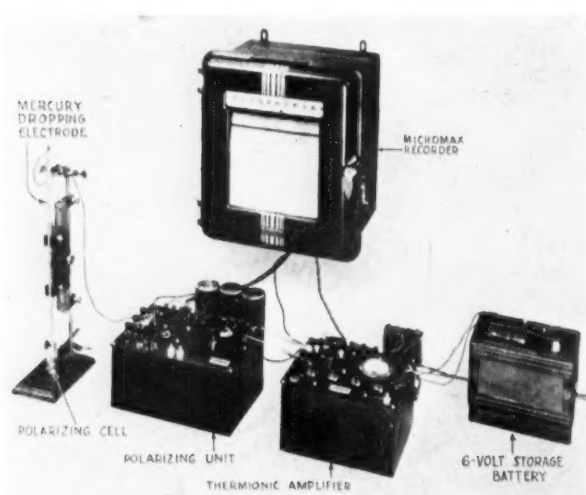
Polarograph

The polarograph is an instrument that measures the current behavior of a dropping mercury electrode. From the shape of a voltage-amperage curve, rapid and accurate analyses can be made.

This instrument can be compared with the colorimeter for its ability to detect very small amounts of substances in solution. Like the colorimeter it is a specialized instrument that has definite applications. One of its outstanding characteristics is that it can be used to analyze for more than one metal from the same solution. For this reason it has been used to analyze deposits from brass baths.

A manually operated instrument is available that is rapid and accurate.

A continuous recording instrument is available that is very convenient for research on new plating methods.



Courtesy Leeds and Northrup Company
Figure 7. Recording polarograph.

Instrument Selection

By this time it appears that a plating laboratory can be a jumble of instruments. It is true that it can, but each instrument has its place and there is probably no plating laboratory that would need all of the instruments. If you are going to purchase an instrument find out all you can about it. Read the literature, talk to salesmen and make contacts with associates. Determine if you can use it for many jobs rather than one. Much can be done with a centrifuge and much can be done by electrolytic analysis. The problem is: What baths do you intend to control? If you know the analyses you intend to make and the number of analyses you intend to run then instruments can be intelligently selected. A complicated instrument takes time to set up and standardize and although it is rapid in operation it is not rapid if it is only used for a few analyses.

The type of instrument to select depends on the purpose of the measurement to be made. The most expensive instrument is not necessarily the best. A chainomatic balance is desirable because it is rapid but a cheaper balance may be more accurate. A spectrophotometer is desirable for research; but may prove to be clumsy for control.

Table No. 1 indicates the probable preference for instruments to be used for control and for research. For specialized applications exceptions are possible in every case.

TABLE NO. 1

Measurement	Type of Instrument	
	Control	Research
Weight	Chainomatic balance	High sensitivity balance using fractional weights
Meters	Rugged type	Sensitive type
pH Meter	Voltmeter type	Potentiometer type
Surface Tension	Stalagmometer	du Nuoy tensiometer
Conductivity	Cathode ray tube	A. C. galvanometer
Colorimetry	Rapid type	Spectrophotometer
Polarography	Manual type	Recording type

Utilities

A plating laboratory can conveniently use: Alternating current, direct current, gas, compressed air, steam and vacuum, although all of these are not necessary in a small laboratory.

Electricity can be used for heating but for analytical work heating by gas is more rapid. Occasionally it is necessary to heat a plating bath where no metal heater can be used. A glass coil and a source of steam will solve this problem. If steam is not available in steam lines it is a simple matter to generate a small amount of steam for this purpose.

Electric stirrers are convenient for agitation but inexpensive air driven stirrers serve just as well. In



Courtesy Eastern Engineering Company

Figure 8. Temperature controller and relay.

addition air may often be used by bubbling it directly through the bath.

Vacuum lines are convenient to have for the endless filtering that goes on in a laboratory. If vacuum is not available a simple aspirator on the water line will do a good job.

Tanks

Tanks are often a problem in the laboratory just as they are in the shop.

The commonest container used in the laboratory is a beaker. Glass is an excellent material for a container since it is a non-conductor, and it is not attacked by the ordinary chemicals used in plating, except for the fluoride baths. Even fluoboric acid will not attack glass during the time required for short experiments and the small amount of fluosilicic acid formed will not affect the ordinary fluoborate bath.

Popular beaker sizes for plating experiments run from 1 to 4 liters. A good size is a 1½ liter beaker, as it permits the use of 1 liter of solution and yet provides sufficient extra volume for immersion of the anodes and cathode.

Unfortunately beakers are not made in all shapes and sizes, they do not have the properties for all plating requirements and they are often broken by thermal or mechanical shock.

Small steel tanks are excellent for alkaline baths. They are strong, have a long life and are easy to heat from the outside. Furthermore the sides of the tank may be used to carry current for a small electrolytic cleaner or a strike.

Small steel tanks of 16 gage steel may be made with welded seams. Brazing or soldering should not be used on the seams since copper or lead alloys may be attacked by cyanide and ruin both the bath and the tank. A series of these tanks may be stored in a small place by making them of slightly different size so that they will "nest".

If tanks of a square or oblong shape are required for acid baths then the small steel tanks may be sent out to be rubber or plastic lined. A similar tank may be made in the laboratory of solid plastic. These are cheap, and excellent for many purposes for cold or warm baths.

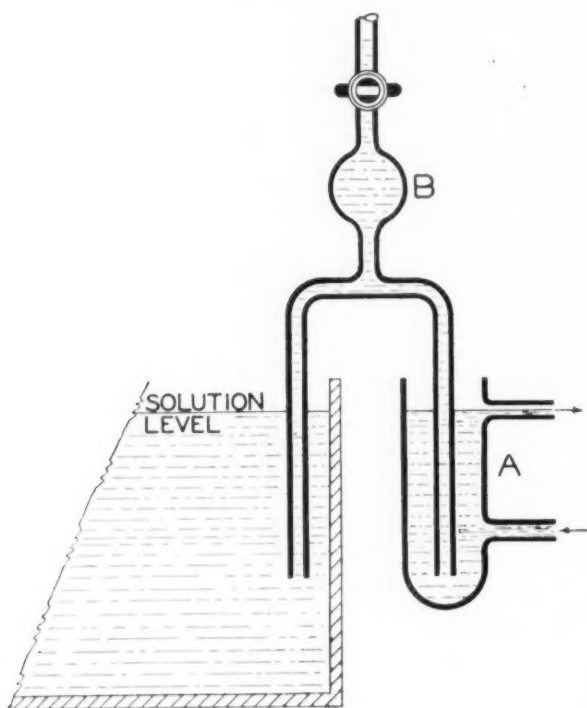


Figure 9. Liquid level controller.

Racks

Racking in the laboratory is solved by use of the same general principles used for production.

Stop-Offs

Commercial stop-off lacquers are indispensable to keep the deposit from places where it is not wanted. In addition to lacquers, a pot of commercial molten wax is an excellent stop-off that is easy to use.

Temperature Control

For laboratory studies, temperature should be controlled within narrow limits. There are many excellent ways to do this and two will be mentioned.

The first method is for heating with electric current; where the bath is set on an electric hot plate or where an immersion heater is used. The heater is supplied with current through a variable transformer.

Set the transformer at any given voltage and allow the bath to come to a constant temperature. The voltage for any other temperature may then be estimated by the following means: The rise above room temperature will be approximately proportional to the watts.

$$\text{Watts} = EI = \frac{E^2}{R}$$

Since the resistance is constant the temperature will be proportional to E^2 .

$$T_2 - T_1 = KE^2 \quad \text{where } T_2 = \text{temperature of bath}$$

$$T_1 = \text{room temperature}$$

$$K = \text{a constant}$$

$$E = \text{voltage}$$

This type of heating is very good for heating a few degrees above room temperature. It will also

hold fairly steady for temperatures up to the full capacity of the heater.

The second method involves a sensitive mercury column. A tube of the shape as shown in Figure 8 is used. The bulb is partially filled with a liquid that has a boiling point near the temperature desired. At such a temperature the liquid is near the point where it will change to a gas and a small change in temperature will mean a large change in volume and a large change in movement of the mercury column. Contact wires are taken to a relay that turns the electric heater on and off.

This apparatus is cheap and is available through chemical supply houses along with a list of liquids suitable for various temperatures.

Liquid Level

When hot plating baths are run for long periods of time the level must be controlled by a continuous supply of fresh water.

The following apparatus of Figure 9 has been found to be reliable for this purpose.

At A, a supply of water is available by continuous flow at a constant level. B is a syphon. By opening the stopcock, water may be sucked up into the reservoir and the leveler will start to control. The bulb in syphon B is necessary to trap occasional bubbles that would break a simple syphon.

Chemicals

Chemicals should be purchased in keeping with

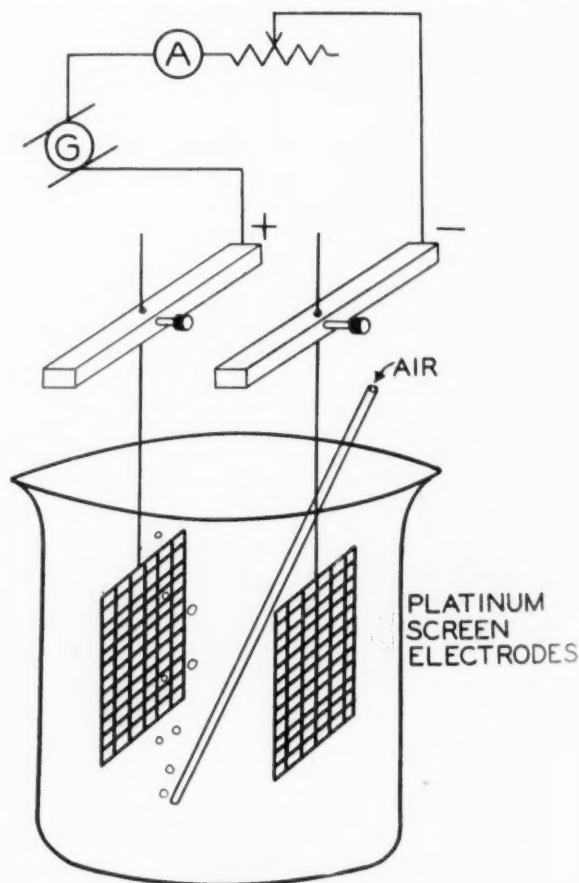


Figure 10. Electrolytic analysis set-up.

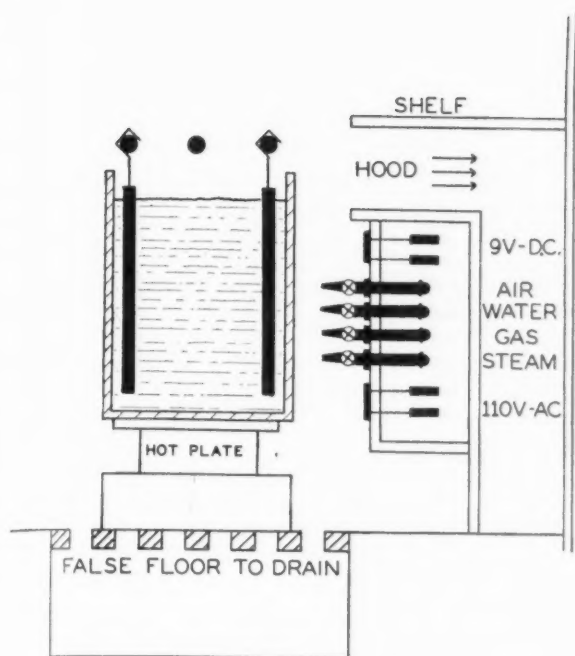


Figure 11. Pilot plant set-up.

the purpose for which they are to be used. For analytical work, C. P. chemicals are of sufficient quality. The cost of these chemicals is low because of the small quantities used.

For experimental work it is advisable to use a technical grade of chemicals so that the same impurities will be present as in a production bath. Also the price is a consideration here, because of the larger amounts used. Technical chemicals are cheaper than C. P., particularly when purchased in large amounts.

For rough control work it is permissible to use commercial chemicals. For instance, if acidity is to be controlled in a pickle, it is permissible to make a standard sodium hydroxide solution from commercial caustic. Such caustic is usually available for an addition to one of the alkaline baths. Commercial acid may be used for a similar purpose if it is free of iron. If iron is present in the acid it may be difficult to recognize the end-point in a titration.

If there is a question of economy in the use of chemicals, initial tests may be run with both C. P. and technical grades.

Water

Distilled water is generally used throughout in analytical work. At times it is inconvenient to have distilled water for control work in the shop and it will be found that in most analyses tap water is just as satisfactory as distilled water. In case of a question, tests may be run with both kinds of water to determine if there is any difference. For analytical work in the laboratory, it is best to use distilled water to avoid occasional troubles. For instance, if silver nitrate solution is made with tap water, some of the silver will be precipitated by the chlorides that are always present in such water.

Tools

Plenty of cheap tools should be available in any

laboratory. Buy one more pair of pliers and one more screw driver than you think you need. It is far more economical to have extra tools on hand than to spend time looking for them. If you think you need 30 battery clips buy 80. Never run out of wire, or steel strip to plate on.

Have plenty of bailing wire on hand, and some copper wire and a little platinum. Experiment with other kinds of wire such as aluminum and tungsten. Have a soldering iron and a blast lamp and if it is at all possible learn the elements of glass blowing. If you can learn to join two pieces of glass together and if you can learn to make a glass "T", you can make almost anything of glass.

Take some time off and visit a radio shop. If you see inexpensive plugs and switches that look inviting buy a few. Some day they will be just what you need.

Keep small parts such as binding-posts, nails, bolts and screws in small bottles where you can always find a way to make what you need. Keep plenty of small, cheap parts on hand. One small 10c binding post may be worth \$5 some day in time saved. That \$5 will pay for much of the small material that you may never use.

Some of the art of plumbing, carpentry, radio-repair and glass blowing will help you to be a better plater.

Electrolytic Analyses

Electrolytic analyses are accurate and easy to carry out for many of the metals. A balance, a source of current, a means of controlling the current, a pair of electrodes and a means of agitation are required. It is not necessary to have a special machine to do this job. Plating machines are for the convenience of analytical chemists who have no other contact with plating than an occasional electrolytic analysis.

Figure 10 shows a set-up that may be used for electrolytic analyses.

A voltmeter is not required and in most cases heat is not required. If heat is necessary the set-up may be made on an electric hot plate.

Small Scale Plating

The plating laboratory may at times take on small scale plating jobs. Or it may even become a pilot plant.

If full size pieces are to be plated the usual laboratory scale is too small because the baths are not of sufficient size. Too much time is consumed in plating many pieces on this scale. On the other hand full scale tanks are too large to run a few hundred pieces if special baths are required. It is not economical to make 500 gallons of solution for several hundred pieces. After the pieces are plated special solutions have to be stored or dumped and either procedure is expensive. In addition it often takes several days to get a 500 gallon tank ready for plating.

A good scale for this type of work is in the range of 10 to 50 gallons, depending on the size of the pieces and the number to be plated.

Ten gallon baths are relatively easy to make up, including solution of chemicals, filtering, adjustment

(Concluded on page 74)

Fluid Mechanics: Forgotten Factor in Electroplating

By Joseph B. Kushner, Metal Finishing Consultant, New York, N. Y.

"WE HAVE been telling platers to study chemistry and metallurgy. I now want to suggest that they study hydraulics."¹

For over a hundred years the subject of electroplating has been studied from the viewpoints of chemistry, electrochemistry and metallurgy. Yet, in all this time with the exception of the very recent past, a science which in its own way is just as much involved with plating as these three has been sadly neglected. In fact it would not be amiss to call it the forgotten factor in electroplating. What is it? Fluid Mechanics!

Fluid Mechanics is the science of the physical and mechanical properties of fluids both at rest and in motion. It is involved with electroplating obviously because the plating bath from which we deposit metal is a fluid. The relationship is so palpable however, that we fail to consider it important if we consider it at all. We know the chemical and electrochemical properties of this fluid we call the plating bath are important because they control the nature and type of deposit we get on our cathode, but the properties of the plating fluid *per se* are so seemingly unimportant we tend to neglect them. Yet the actual physical properties of the plating fluid can influence the nature of the cathode deposit to a large extent as well as affect other aspects of electrodeposition. It is the purpose of this short paper to point out some of these relationships and indicate possible avenues of fruitful research. It is the writer's firm belief that many important advances in electroplating and other electrochemical processes are going to be made because of studies in fluid mechanics.

¹ Dr. William Blum, 1939 Convention, American Electroplaters' Society.

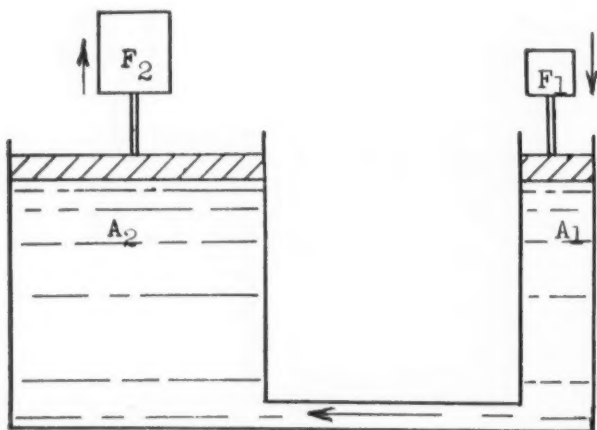


Diagram 1. Pascal's law.

Fluid Mechanics Fundamentals

Before launching a discussion on the applications of fluid mechanics to electroplating it may be advisable to brush up a little on some of its terminology and fundamentals. A partial list of definitions and theorems is given here.

1. The pressure developed in a fluid whose density is d , at a depth H below the free surface of the fluid is equal to $P_0 + Hdg$ where g is the gravity constant and P_0 is the pressure at the free surface (atmospheric pressure, approximately 15 lbs. per sq. inch).

2. The total pressure on an area A of an object submerged at a distance H below the free surface of a fluid is equal to $AP_0 = A(P_0 + Hdg)$.

3. Pressure exerted at any point in a confined fluid is transmitted undiminished in all directions. This is sometimes known as Pascal's Law. Diagram 1 will make this principle clearer. In the two connected vessels of cross section A_1 and A_2 a force F_1 is applied by means of a piston to A_1 . The pressure developed in this chamber in lbs. per sq. inch, is $p = F_1/A_1$. This pressure is transmitted undiminished through the fluid in such a manner that at the surface A_2 (at the same level as A_1) a force $F_2 = pA_2$ is developed. Thus if A_1 were an area of 1 sq. ft. and A_2 of 100 sq. ft. a force of 1 lb. on A_1 would lift 100 lbs. at A_2 . This is the principle behind the hydraulic jack and the hydraulic press.

4. A body wholly or partly immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced. That is known as Archimedes Principle. It follows from this that bodies of specific gravity greater than unity will sink and those of less than unity will float.

5. At interfacial surfaces (liquid and air, liquid and solid) liquids tend to contract in such a way as to expose a minimum of surface. The force which arises from this phenomenon is called surface tension.

6. The internal friction forces of fluids whereby they resist forces tending to change their shape or deform them, is called viscosity.

Measuring the Thickness of an Electrodeposit

An extremely simple application of fluid mechanics that aroused some interest in the fairly recent past is the use of Archimedes Principle to determine the thickness of an electroplated metal on a cathode of simple shape. The cathode, which must be of regular geometric configuration, is weighed, first in air and then in water. Now a deposit of metal is put on and

the piece is weighed again both in air and in water. We have from Archimedes Principle, the volume of the cathode before plating equal to:

$$V = \frac{W_a - W_w}{d}$$

where W_a is the weight of the object in air and W_w is the weight of the object in water, and d is the density of the water, all in consistent units. The volume of the cathode after plating equals:

$$V_p = \frac{W_{ap} - W_{wp}}{d}$$

where d has the meaning given previously and W_{ap} is the weight of the plated cathode in air and W_{wp} the weight of the plated cathode in water. Since d for water is unity, the volume of the deposit is $V_p - V$, or

$$W_{ap} - W_{wp} - W_a + W_w$$

The area of the cathode being accurately known from its measurements, the thickness of the actual plate is

then $\frac{V_p - V}{A}$ where A is the area of the cathode. This

value is of course the average thickness of the deposit. Thus, for a thin rectangular piece of dimensions a and

b and thickness of the deposit is $\frac{V_p - V}{ab}$ for a disc

of radius r , $\frac{V_p - V}{r^2}$ and for a triangular shape (thin)

of altitude h and base b , $\frac{2(V_p - V)}{hb}$. All measure-

ments, particularly those of weighing, have to be made quite accurately as the method depends on small differences of relatively large numbers.

Plating Under Pressure

The pressure of the atmosphere is approximately 15 lbs. per sq. inch at sea level and this is the pressure under which most plating baths operate. Would there be any advantage in electrodepositing metals at high pressures?

The writer is not aware of any specific work on the effect of high pressures on electrodeposition and is frank to admit he has not done a great deal of searching in the literature in this connection. However, off hand, it can be said that such data are scarce. The only person the writer knows to have plated objects under pressure was a mechanical engineer whom the writer met some years back. He claimed to have gotten excellent results in electroforming copper fittings at pressures of 10 atmospheres (150 lbs./sq. in.) and more, but was skimpy with his details and vanished from the writer's ken before the subject could be taken up any further.

On general theoretical grounds it does appear that plating under pressure might be an extremely valuable technique, particularly in electroforming. Consider the hypothetical pressure plating tank illustrated in Diagram 2. By compressing the air in the space above the electrolyte we can produce any pressure we desire in the body of the liquid. This pressure will by Pascal's

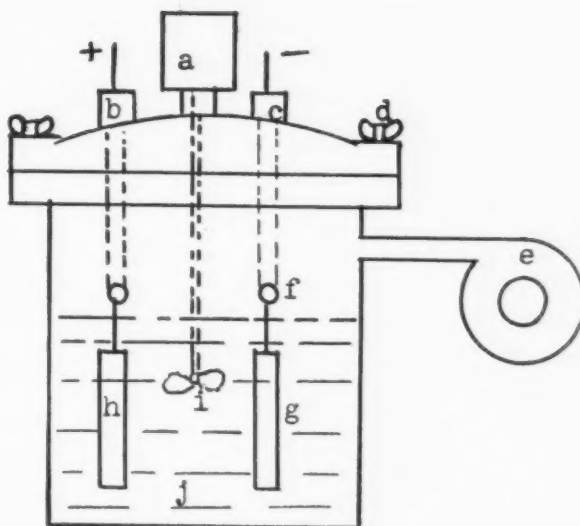


Diagram 2. Hypothetical case of plating under pressure, a—stirrer motor and well; b—anode well; c—cathode well; d—high pressure closure; e—compressor; f—electrode support; g—cathode; h—anode; i—propeller; j—plating bath.

Law be transmitted without loss to every part of the bath. What would be the advantages of such a system? Let us look at some of the theoretical aspects:

1. Increased pressure will bring about more effective wetting action. This is indicated by the fact discovered over 50 years ago² that liquid surface tension is reduced as the pressure increases. The original investigator, Kundt, found that reductions of surface tension as much as 50% were obtained at pressures of 150 atmospheres. Another interesting fact was that the atmosphere over the liquid being tested had a bearing on it too. Thus carbon dioxide produced greater reductions in surface tension than did hydrogen or air.

2. Higher pressures should tend to give higher cathode and anode efficiencies. Plating-out of a metal is an electrochemical reaction and it will be affected by the principle of Le Chatelier just as any other chemical reaction is affected thereby. This principle states in effect that if an external force is placed on a chemical reaction, the reaction will tend to go in such a way as to diminish the effect of the force. To put it crudely, the reaction "rolls with the punch." This means then, for example, if we had a plating bath with 80% cathode efficiency with no other electrode reactions taking place but the evolution of hydrogen, then for each Faraday of electricity passed through the tank at atmospheric pressure, 0.8 of an equivalent of metal and 0.2 of an equivalent of hydrogen would be deposited at the cathode. If we now increased the pressure considerably in the closed pressure tank shown, hydrogen evolution would be greatly diminished since hydrogen being a gas, would increase the pressure in the tank if it were evolved which would be contrary to the principle of Le Chatelier. Accordingly, the electrochemical reaction will favor the increased production of metal at the cathode since the metal deposit will occupy a smaller volume of space. The same should hold true at the

²Ann. Physik. Vol. 12, 538 (1881).

anode; oxygen evolution will be diminished in favor of anode dissolution. It might thus be possible to more closely approach the actual value of the theoretically possible cathode efficiency in chromium plating by plating it under pressure; but then on the other hand, perhaps in this case there would be no deposit at all, the whole reaction being a reduction from hexavalent to tri-valent chromium.

3. In most plating baths conductivity will be increased under high pressures. The few tests that have been made indicate that dissociation of weak electrolytes is increased as the pressure goes up leading to marked rises in conductivity and that in the case of strong electrolytes conductivity is slightly increased.

4. The viscosity of the plating solution will be only slightly increased at high pressures when operating at a fixed temperature. This is a surprising fact inasmuch as one would think that the internal friction forces would increase markedly as the pressure on the fluid is increased. Yet in a case in point, water, the viscosity increases only 10% in going from a pressure of one atmosphere (temp., 75°C) to 1,000 atmospheres at the same temperature. This fact, in conjunction with the following fact regarding temperature and viscosity, should tend to permit the use of much higher current densities with good deposits.

5. At high pressures, much higher temperatures can be used in the plating bath. Thus, at a pressure of 100 atmospheres a temperature of 300°C can be approached in aqueous solutions, without boiling. If the diffusion coefficient of such a solution increases roughly by 2½% (equivalent of the coefficient of viscosity decrease) for every degree rise in temperature

the increased diffusion rate should permit the use of very high current densities without burnt deposits.

6. Last but not least and probably most important from the standpoint of metallurgical properties, is the structure of the deposit plated-out under high pressure. There can be no doubt that the pressure on the deposit as it is being formed will help bring about a smoother, more compact, denser and stronger structure. The densities of electrodeposited metals tend to be a little lower than those of the same massive metals; in plating these metals out under pressure we can safely assume the densities would be at least as great if not greater than those of the massive metals. Because the pressure would be transmitted to each and every part of the object being plated, parts incapable of being formed in a metal press could be readily formed in the plating bath.

If we can consider electrodeposition as a form of "cold casting" as so aptly put by Dr. Wesley, plating under pressure would be a form of "cold die casting". It is normal to expect that such metal structures would be both enormously strong and hard. There would be great advantages in the electroforming under pressure of at least certain metallic objects. Thus if tungsten, possibly alloyed with other strong corrosion resistant and refractory metals, could be plated out under these conditions, we would have here a wonderful way for making the high temperature and pressure-withstanding impellers and rocket jet tubes we need so badly in our new atomic age! The subject of plating under pressure appears to be a lush field for the investigator willing to spend some time and money on it. Yet this is only one of the many facets of the application of fluid mechanics to electroplating.

ELECTROPLATING CONTROL LABORATORY

(Concluded from page 71)

and initial electrolysis. For most chemicals this much solution may be dumped after use. Even if the solution is stored, the space required is not excessive.

Baths of the 10 to 50 gallon size are large enough that a good indication is obtained of behavior on full scale. Baths in the one to four liter range are not large enough for this purpose. Such small baths will change too rapidly if used excessively and give a false impression of control on full scale. The 10 to 50 gallon size is thus a practical size for plating sample pieces and for pilot plant work.

Figure 11 shows a set-up that may be used for small scale plating.

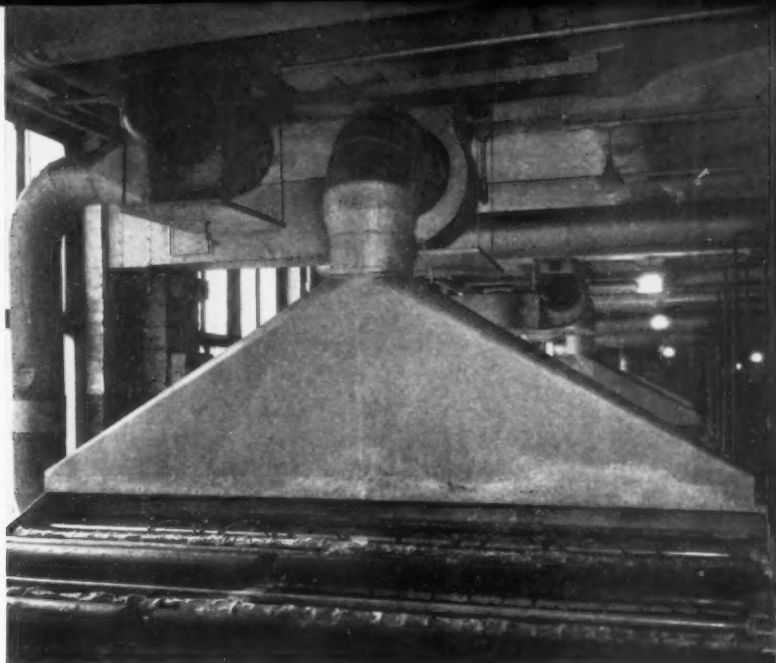
In this arrangement the hood and facilities are permanent but the tanks may be readily moved to

storage. Any sort of tank, apparatus or table may be set next to the hood for experimental work on small scale plating.

Conclusions

This paper was intended to indicate that many tools are available for a plating laboratory.

It should not be said that such a laboratory should use a chainomatic balance or carbon compression rheostats. Instruments should be selected that best meet the estimated needs for experimentation, analysis and control. Whatever physical aids are decided on, they should be economic. If an instrument is for occasional use it should be cheap. If an instrument is for daily use it should be rapid. If maximum accuracy is essential, then both price and time become unimportant.



(Courtesy National Safety Council)
Plating tank exhaust hood to remove toxic fumes.

Toxicity of Chemicals in Electroplating

Conclusion

By P. M. Van Arsdell, *Benson & Associates, Chicago 4, Ill.*

WHEN the operator leaves the work, the symptoms clear with the exception of persistent bouts of coughing in the night which may endure for about one-half hour. When the work is resumed the symptoms recur. Certain typical skin reactions may also develop in some individuals; this is characterized by a scaly red rash. Blood checks, skin tests, and x-rays do not reveal any abnormalities leading to the lesions noted. Precautions lie in minimizing the exposure by adequate ventilation. Treatment consists in removal from exposure and consultation with a physician with full history of the exposure.

Palladium salts commonly used in plating are the chloride and the amino-nitrite. So far as is known the palladium salts do not constitute any threat of injury in industry, but laboratory tests show that when these substances are introduced in animals damage occurs to the heart, kidneys, liver and bone marrow.⁴⁷ From these indications it would seem that palladium salts should be carefully watched for chronic and cumulative toxic effects.

Silver and Its Salts

Silver plating is one of the oldest operations in electroplating and the compounds used are extremely toxic. Silver nitrate and silver cyanides have an extremely corrosive and discoloring effect on all tissues they contact. The nitrate salt is astringent and extremely corrosive in high concentrations when it

contacts either skin or mucous. The reaction is at first marked by white areas which upon exposure to light turn light then dark gray and finally black by the precipitation of metallic silver.^{46, 65}

The cyanide salt in warm solutions releases cyanide to the atmosphere making it almost instantly fatal upon inhalation. All baths containing cyanide solutions should be plainly marked for precautionary measures and good ventilation should be maintained at all times whenever these compounds are present.

In buffing operations following the silver plating procedure, care should be exercised to prevent the presence of any dust in the air from the silver objects as the silver dust is mobile in the blood stream and is deposited in the skin and the eyes of the workers giving rise to a peculiar bluish gray cast of the skin and eyeballs. This is known as argyrosis and is next to impossible to correct once the silver is deposited in the skin and eyeball area. The initial symptoms of silver deposition are a peculiar yellowish gray cast in the whites of the eyes and later the cornea may be colored the same way. The entire area of exposed skin darkens with exposure to light.^{50, 68}

Tin and Tin Salts

The wide application of tin plating for the storage of foods has proved that metallic tin is non-poisonous to the greater proportion of the population of the world.⁴⁴ However, the tin salts used in tin plating

may be the source of some skin reactions due to the release of acid or base ions from the salt, depending upon the type of bath used.^{8, 56} These ions act as irritants especially on broken skin, but the tin ion itself is non-toxic.

Zinc and Zinc Salts

Although zinc may be deposited from the salts of many acids, only the cyanide and sulfate baths are of industrial importance. The chloride zinc bath has found a limited application while zinc sulfate is the salt ordinarily used to furnish the metal ions.⁴³

Inhalation of zinc compounds may give rise to some respiratory difficulties, however the main danger from zinc in electroplating arises from the effects of the cyanides and caustics and dermatitis is often seen when either the sulfate or the cyanide are contacted frequently. The skin reaction is characterized by reddish blisters which may begin at the hair follicles and develop into boils, ulcers, or eczema. The first stage of this reaction is an unbearable itching. The chloride and cyanide form pit-like holes, with little or no swelling.^{45, 64} Treatment consists of washing skin areas with sodium carbonate to precipitate the zinc as the relatively innocuous carbonate when the acid bath is contacted, and when the cyanide bath is contacted hydrogen peroxide and boric acid are more specific treatment. Once the dermatitis subsides, it usually does not recur and only in highly susceptible individuals are lasting effects noted. Rubber gloves and impervious clothing should be worn in such atmospheres.

Conjunctivitis may occur²⁴ and should be immediately treated as the irritation follows the general order of those symptoms described for the dermatitis. When either the sulfate or the chloride reach the eye, immediate irrigation with water is mandatory; to prevent such entries goggles should be worn. The effect of the caustic or cyanide splash in the eyes is extremely painful. The eyes should be copiously

flushed with water and later boric acid may be used.

Ingestion of zinc chloride causes corrosion of the lips and mucous tissues of the mouth. There is pain and burning of the stomach with incessant vomiting of blood stained fluid. Other symptoms include difficulty in swallowing, accelerated pulse and difficult respiration. In more severe cases of poisoning, convulsions, paralysis, coma and even death occur. First aid treatment consists of administering plenty of warm water containing sodium bicarbonate to wash the stomach. If the bicarbonate is not available, milk and eggs may be given freely with plenty of water, or strong tea may also be given.⁴⁹

Zinc sulfate is usually a prompt and effective emetic, for this reason its use is recommended in many first aid procedures.^{45, 65} However, on inhalation or contact, its effect is much the same as for zinc chloride although it is less pronounced.²⁴

Anions and Electroplating

Three fairly definite, though not sharply defined, types of aqueous solution are used in electroplating, commonly designated as (a) "acid", (b) "neutral", and (c) "alkaline" baths. These types may be roughly defined in terms of pH respectively; (a) lower than 2; (b) between 2 and 8 and (c) higher than 8. Examples of these three types are (a) acid copper baths, (b) nickel (including low pH nickel); and (c) cyanide baths of various metals.¹¹

The most commonly used anions and cyanides, sulfates, and chlorides; these are added either as the acids or as the salts, such as the cyanides. A general resume of the toxicity of these compounds is as follows:

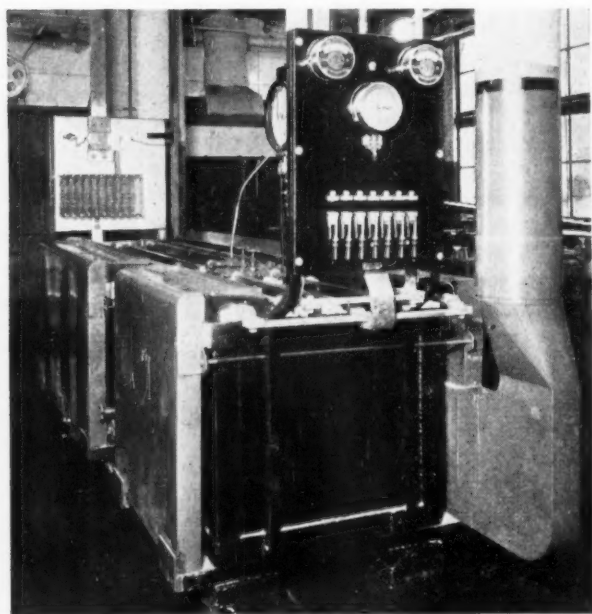
Acids

Concentrated acids are corrosive to the skin causing heat and itching at first contact and within a fairly short time, considerable burning and later blistering. When acid fumes are inhaled, laryngitis, bronchitis and considerable destruction of lung tissue may follow if the contact is of any duration. Chemical pneumonia is a natural reaction to the tissue destruction. Immediate removal to fresh air is imperative.^{46, 65}

The first treatment for acid contacts is to use plenty of water to secure the greatest dilution within the shortest possible period.^{46, 65} Rapid dilution with water is especially important when acid is splashed in the eyes.

Ingestion of acid causes corrosion of the upper digestive tract with intense pain, vomiting, swelling of the tissues, collapse and even death within a short period. Alkaline carbonates or magnesia may be safely administered for ingestion. The cardinal rule for all serious contacts or ingestions after administering first aid is to summon a doctor immediately.^{46, 65}

Generally, in the electroplating operation, acids are used in dilute solutions, although from time to time the concentrated acids must be added to maintain proper concentration in the bath. Because of the nature of the electroplating baths, the hydrogen generated will carry out certain concentrations of vapor to the atmosphere. The acid spray naturally contaminates the atmosphere, and depending upon the



(Courtesy National Safety Council)

Plating tank exhaust hoods; new improved construction.

nature of the acid, constitutes a more or less hazardous condition.

Sulfuric acid in the dilutions used in plating is not particularly dangerous, however care must be used when handling the concentrated acid as it constitutes not only a serious health hazard but a fire hazard as well. Splashes in contact with organic material char and burn; this is particularly true when wood or packing materials of a cellulosic type are splashed and no precautions are taken to prevent combustion taking place. Plenty of water should be used to dilute the acid and prevent the liability of fire.⁶⁹

Hydrochloric acid fumes are particularly unpleasant, causing irritation of the skin and mucous membranes. Their reactions follow the pattern outlined above for acids generally.

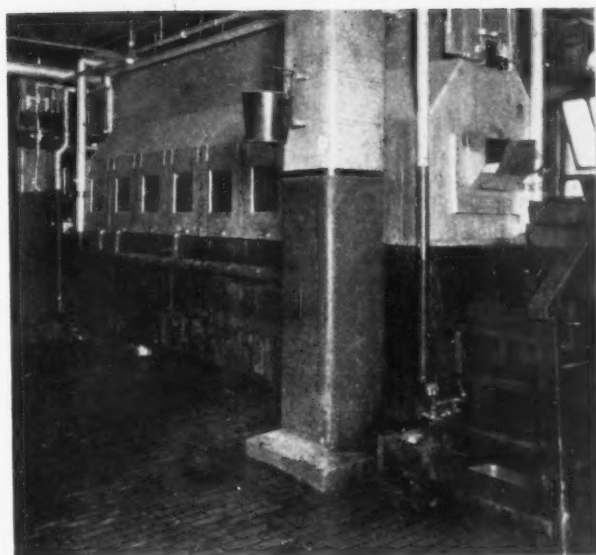
Nitric acid on contact with the skin is extremely irritating, producing the familiar yellow-brown coloration wherever it contacts. Vapors and fumes from this acid may be particularly dangerous as they carry the nitrogen oxides which upon inhalation are responsible for delayed reactions of a particularly insidious nature. Whenever a workman has inhaled any nitric acid vapors or nitrogen oxide fumes, he should be removed to fresh air, and if any untoward symptoms develop he should be hospitalized until the danger period of 5 to 24 hours is past.

Perchloric acid and the perchlorates are hazardous not only from the toxic action on the body, but from an explosion and fire standpoint as well. Organic compounds in the presence of perchloric acid explode violently. When any type of phosphorus containing materials contact perchlorate salts there is a danger of fire and/or explosion.⁴⁸ On contact with the skin, perchloric acid causes deep and penetrating sores. Swallowing perchlorates in high concentration cause stomach upset, vomiting and abdominal pain; bluish coloration of the skin, collapse and terminal convulsions result from the change in the blood. Kidney involvement is shown by lumbar pain, albumin and casts in the urine and sometimes cessation of the kidney function.⁴⁰⁻⁶⁵ First aid consists of washing the stomach with copious amounts of water and administration of hot drinks. A physician should be called as soon as possible in order to treat the symptoms as they arise.⁶⁵

Alkalis

The alkalis, sodium and potassium hydroxides and carbonates are widely used in plating operations. These have a corrosive and destructive effect on the body tissues which may be more damaging than the action of acids. This is particularly true of the dilute solutions. These compounds withdraw water from the tissues and form soaps with the skin and underlying fats which accounts for the prolonged "soapy" feeling experienced after contact with the alkalis has been made.

Caustic burns, as a rule, penetrate deeper than acid burns. This is especially noted in caustic eye burns. When either caustic dust or solution contacts the eyes, it must be removed by washing with plenty of water for at least five minutes, for the cornea is often



(Courtesy National Safety Council)

Enclosure system to confine acid to prevent contamination of air in workroom.

destroyed in this time if immediate washing does not carry the material away.

When swallowed, caustics may remove the entire mucous lining of the digestive tract and mouth. The following treatment should be given promptly—large quantities of water to which vinegar or lemon juice has been added for neutralizing the alkali present. This may be followed by administering vegetable oils, animal fats or milk. A doctor should be summoned to treat the other symptoms as they arise.

A mild ointment with a heavy oily base will help to restore the oils to the skin that have been lost by contact with the alkali compounds.^{36, 65-72}

Cyanides

Cyanide salts are extensively used throughout the plating industry. They are among the most poisonous compounds known today. Copper, zinc, and sodium cyanide are used in the brass and bronze bath; sodium cyanide in the cadmium bath; copper cyanide in the copper bath; gold, potassium, sodium, copper, nickel, and silver cyanide in the gold bath; silver, sodium, and potassium cyanide in the silver bath, and zinc and sodium cyanide in the zinc bath. Most plating shops have a number of cyanide baths continuously in operation.

Cyanide ions are a rapidly acting poison; they enter the body by inhalation, ingestion and skin contact. The salts which free the cyanide ion in the body are extremely toxic.⁶⁵ Hydrogen cyanide is given off from a bath containing any of the cyanide in solution.

On inhalation, hydrogen cyanide hinders the normal oxidation processes and is asphyxial in effect. Very low concentrations of cyanide vapor have the following chronic effect; watering and itching of the eyes, headache, pounding of the temples, difficulty in breathing, excessive saliva, stupor and pain in the digestive tract, with possible convulsions and collapse. These symptoms appear in the following order, irritation of the conjunctiva and throat, coated tongue

TABLE II
TOXIC REACTIONS AND FIRST AID PROCEDURES

TOXIC ACTION		FIRST AID		
	Swallowing	Skin Contact	Eye Contact	Skin Contact
ACIDS				
	A few cc. of concentrated acid causes intense pain in mouth, with blistering of the tongue, lips, and throat; laryngitis, lung inflammation, vomiting, destruction of digestive tract, feeble rapid pulse, general weakness and collapse.	Extremely corrosive giving acid burns. H_2SO_4 may give white or brown coloration of tissues.	Acid burn.	Flush with plenty of water, apply soda bicarbonate paste. Call a doctor.
	Highly corrosive even in low concentrations. One lungful produces almost immediate death (few minutes to 10 hrs.). Acute irritation of digestive tract, abdominal pain, diarrhea, and vomiting.	Blistering and gray, white to purple appearance. Burn may be delayed in action and penetrate very deeply.	Acid burn with blindness from concentrated acid.	Wash and use magnesium oxide paste immediately; if action continues, see doctor.
	Readily absorbed, caustic, with difficult swallowing, followed by burning in mouth, stomach, and throat. Rapid collapse preceded by convulsions.	Corrosive, loss of fingernails due to its action.	Acid burn.	Wash thoroughly and often when working with oxalic acid.
ALKALIS				
	Soapy nauseous taste, burning pain in throat, lungs and stomach. Is not as destructive to tissue as NaOH or KOH.	Roughens skin, produces caustic burns in concentrated solution.	Corrosive, causing burning and rapid penetration of deep tissues.	Lemon juice, weak solution of vinegar, oils, animal fats or milk.
Sodium Hydroxide and/or Potassium Hydroxide	In concentrated solution the entire lining of the mouth and digestive tract is destroyed. Water is withdrawn from surrounding cells which causes deep penetration.	Caustic burns which penetrate deeply because the protective layer is dissolved by alkali action.	Deep penetrating burns, resulting in blindness from action on eye tissue.	Dilute with large quantities of water to which vinegar or lemon juice has been added. Follow with a tumbler of salad oil.
Calcium Hydroxide	In dry form or in high concentrations, —caustic burns.	Irritating, causing eczema-like eruptions with blisters. Skin peels in large flakes.	Small amounts of dust may cause blindness—treat as a caustic eye burn.	Give plenty of water; treat as for other caustic burn.
Barium Hydroxide	Weakness, salivation, and nausea. Vomiting and diarrhea; severe abdominal pains.	Eczema and cyanosis, irritating to sweat glands, may bleach hair and eyebrows.	Acts as caustic.	Cleanse thoroughly and apply boric acid or benzoic acid ointment.
COMPOUND Chloride Salts of Ammonium Cobalt Iron	May be astringent in low concentrations; corrosive and burning in high concentrations HCl may be released in digestive tract. Vomiting and stomach inflammation and diarrhea follow.	Solutions are astringent and drying. Dry salts are hygroscopic and may produce burns.	Irritating; concentrated solutions burn and corrode eyes.	Give plenty of water to wash stomach. Starch or flour water and egg whites halt reaction. Epsom salts flush system, give as a laxative after plenty of vomiting.
	Corrosion and burning in digestive tract; violently emetic; produce metallic taste, some kidney and liver damage when salts remain in system.	Itching and burning, followed by development of severe dermatitis.	Highly irritating.	Wash thoroughly; apply lanolin ointment. See doctor if irritation is prolonged.
	Immediately and violently emetic, accompanied by dizziness and shallow breathing and colic with diarrhea—kidney disturbances.	Irritation and inflammation. Ulceration occurs in nasal septum on inhalation.	Irritating.	Give plenty of water to insure dilution, call doctor.
Cadmium				
Mercuric	Irritating and corrosive to entire digestive tract. Burning sensation in throat, astringent metallic taste, salivation, great thirst, abdominal distress and pain. Vomiting occurs in about 5 minutes, diarrhea in 2 hours. In severe cases a few hours with ordinary low concentrations.	1-5% solutions produce irritation, drying, and corrosion. Absorption from intact skin may be sufficient to cause general poisoning.	Irritating.	Remove poison from stomach by administering solution containing sodium bicarbonate; administer milk minus cream mixed with raw egg yolk. This treatment must be given promptly. Call doctor.

General poisoning. In about 5 minutes, dizziness, tremors, and death occurs in a few hours with ordinary low concentrations.

This treatment must be given promptly. Call doctor.

ACIDS

CYANIDE SALTS OF ALK. METALS USED IN PLATING

If HCN is released in body it is deadly. Symptoms include difficulty breathing, throat irritation, heart palpitation, difficulty breathing, watery eyes, headache, giddiness and collapse. Respiratory center is paralyzed.

NITRATE

Salts

Potassium Sodium

Mercuric

Severe abdominal pain followed by muscular weakness, vomiting, frequently bloody stools, irregular pulse; straining to evacuate both kidneys and bowels, convulsions and collapse. Stomach irritation may be so violent as to lead to early and fatal end within 20 minutes to 5 hrs.

Silver

Irritating and corrosive to entire digestive tract. Burning sensation in throat, great thirst, metallic taste, also all symptoms of nitrate poisoning shown above.

Astringent, irritating and very caustic. Produces all other symptoms of nitrate poisoning shown under nitrate symptoms above.

Sulfate Salts

Aluminum Ammonium Cobalt Magnesium Nickel Potassium Sodium (Glauber's Salts)

Copper Zinc

Cadmium

Promptly emetic in action. Immediately and violently emetic accompanied by dizziness, shallow breathing and colic with diarrhoea. Kidney disturbances.

CHROMIC ACID and DICROMATES

Sulfides

OTHER SALTS

Ferricyanides Ferrocyanides Tricyanates—except from metal poisoning from metallic cation

ARSENIC

Sore throat, great thirst vomiting and diarrhea with severe abdominal pain followed by collapse and death.

TOXIC ACTION

Swallowing

Skin Contact

Eye Contact

FIRST AID

Swallowing

Skin Contact

Eye Contact

Administer hydrogen peroxide or potassium permanganate in water. The latter solution should be Burgundy red. Induce vomiting by mustard water emetic. Call doctor.

Immediately give plenty of water to insure dilution and washing of stomach. Give emetic if vomiting is not present. Starch and flour water, milk and egg whites will absorb some of nitrate. Call doctor.

Give plenty of water immediately with sodium bicarbonate. Give milk minus cream with raw eggs. Call doctor.

Give 1 teaspoonful of table salt to 1 pt. of water to induce vomiting. Continue treatment until washings fail to show a precipitate.

Give plenty of water, as sulfates tend to withdraw water from body tissues. See a doctor if other symptoms develop.

Wash thoroughly, and if dermatitis appears a doctor should be consulted.

See above.

Use a wash of 5% sodium thiosulfate for all contacts. See a doctor if skin lesions appear. Use petrolatum in nasal passages for brief exposure.

Wash with plenty of water. See a doctor if other symptoms develop.

Wash thoroughly. Use lanolin cream salve to alleviate drying.

When skin reaction appears see a doctor immediately.

Call a doctor promptly. Induce vomiting. Wash stomach with salt water, follow by castor oil or equal parts of oil and lime water. Then wash stomach with ferric hydroxide solution made with 125 cc. of ferric sulfate diluted with 125 cc. of water to which is added 10 gm. of MgO, dilute entire to 750 cc. Give 4 oz. at a time.

Highly irritating to mucous linings of eye area.

May be absorbed through skin or by inhaling. Symptoms same as for swallowing, small concentrations produce inflammation and later dark pigmentation with eczema.

Irritating in high concentrations.

No effect other than drying.

Irritating and corrosive.

High concentrations loosen hair and soften skin. On inhalation H₂S is as toxic as cyanide.

Irritating—may produce conjunctivitis.

Continued exposure shows ulcers known as "chrome holes." Nasal septum may be pierced. Acid (conc) contacting face has been known to cause death.

Irritating.

Drying and irritating—ulceration of nasal septum.

Irritating.

Irritating in high concentrations or on prolonged contact.

Astringent and may be irritating causing dermatitis, especially Co and Ni.

Produces burns on eye tissue.

Burns skin and mucous tissues turning them black after exposure to light. Silver compounds under skin may cause gray to blue black skin colorations.

Highly irritating.

Irritating.

Astringent and drying in high concentrations or in crystalline form. May produce dermatitis if contact is prolonged.

Wash skin thoroughly as soon as contact occurs—wash closely for symptoms listed under swallowing.

Wash thoroughly—consult a doctor if dermatitis occurs.

Remove immediately, wash with plenty of water. See a doctor if untoward symptoms occur.

Wash with salt water and treat as for burns.

Wash with plenty of water.

WITH PLENTY OF WATER FOR AT LEAST FIVE MINUTES.

and possibly an enlarged and sensitive liver.⁴⁰ High concentrations of cyanide vapor paralyze the respiratory center in the brain. While the inhalations have generally proved fatal, there have been a number of reports showing that intravenous injections of sodium nitrate or sodium thiosulfate that have affected complete recoveries.³⁴ Care should be maintained at all times to provide adequate ventilation as masks are ineffective after a short time. The vapors readily penetrate the clothing.

Cyanide solutions are irritant to the skin, and if the skin is broken there may be danger of absorption. On the unbroken skin, it is thought that the alkali carbonates are formed which may produce a caustic burn. To avoid either absorption of the cyanide or an alkali burn, prompt removal is necessary; if any corrosion has occurred, boric acid ointment or wet dressings should be used. The boric acid acts as a buffering agent and the same effect is produced by using either citric acid or citrates in the same way.⁵ Rubber gloves and aprons should be worn to prevent skin contact.

Ingestion of moderate quantities is usually rapidly fatal, although the sodium nitrate or the thiosulfate injections have been used with favorable results.³⁴ First aid treatment consists of giving large quantities of ferrous sulfate in water, or 1% solution of potassium permanganate as a stomach wash, or hydrogen peroxide. Artificial respiration should be given.⁴⁰ Inhalation of ammonium nitrate, which acts as a respiratory stimulant and vasodilator, and exercise to keep the person awake, has also proved helpful as an antidote.

Sulfides

Sulfides and sulfates are frequently used in electroplating operations. Sodium, ammonium and potassium sulfide are the most commonly encountered. These sulfides in contact with hydrogen form hydrogen sulfide which is characterized by the "rotten egg" odor. This gas is extremely poisonous when inhaled in quantity. In certain respects it is even more toxic than the cyanides. Hydrogen sulfide is locally irritating, due in part to its acidity and also because sodium sulfide is formed when in contact with moist tissues. Small concentrations in air produce eye irritation and lung irritation.²¹ In small amounts the odor is very noticeable, but in high concentrations, no pronounced odor is noticed by the individual because of paralysis of the respiratory centre. This effect is one of the factors contributing to its high toxicity.^{21, 36} The symptoms of acute hydrogen sulfide poisoning are nausea, giddiness, headache and coma occurring in rapid order. Repeated exposures to dilute concentrations of this gas produce a chronic eye irritation, bronchitis, digestive disturbances, continual tiredness and skin eruptions, among numerous other manifestations. First aid measures for the overcome person consist of artificial respiration and immediate hospitalization. Eye contacts should be treated first with plenty of water and then a drop of olive oil to alleviate the pain.

The alkali sulfides such as sodium and potassium

soften the outer layer of the epidermis and remove hair in much the same manner as alkali hydroxides. When accidentally swallowed, the action is irritating and corrosive as both hydrogen sulfide and free alkali are freed in the system.⁶⁵ Treatment consists of rapidly evacuating the system; inducing vomiting if not present, and securing medical aid.

Toxic doses of sulfides produce the same systemic effects as those shown for hydrogen sulfide.

Sulfates

The sulfate ions act as cathartics, particularly when combined with sodium, potassium, or magnesium.⁶⁵ Through their cathartic effect they have a tendency to dry the intestinal tissues and slightly increase gaseous metabolism. These compounds also withdraw water from the body tissues, accounting for the considerable thirst when their laxative use is recommended.

Oxalic Acid

Oxalic acid is used in anodizing. It is highly acid producing local irritation and corrosion, violent stimulation and later paralysis which may be caused by tissues being deprived of their calcium through precipitation.⁴⁶ Oxalic acid on the skin is corrosive and loss of the fingernails due to its action is often encountered. The material should be immediately washed from the area; rubber gloves and aprons should be used as protection.

When accidentally swallowed, oxalic acid is readily absorbed. The immediate effects are caustic, with difficult swallowing followed by burning in the mouth, stomach and throat. This is followed by rapid collapse which may be preceded by convulsions. Kidney pains are also present and are a specific symptom of oxalic acid poisoning.

Death by oxalic acid usually occurs much more quickly than with other caustic substances.⁶⁵

The first aid treatment for oxalate poisoning consists of the administration of calcium in any form, i.e., calcium gluconate, lactate, plaster, chalk, lime water and any other readily available calcium source. Quantities of water should be given to prevent the deposition of crystals in the kidneys.⁴⁶ A physician should be promptly summoned.

Hydrogen Fluoride; the Fluosilicates and Fluoborates

Hydrogen fluoride is used in the chromic acid plating bath and in pickling solutions. Fluosilicic and fluoboric acid are used in the lead and other baths.

The toxic element in each of these compounds is the fluorine. Fluorine poisoning may be acute or chronic. Inhalation of one lung full of hydrogen fluoride may be fatal immediately; recommendations by investigators show that permissible concentrations should be below 3 parts per million, if fluorine reactions are to be avoided.⁶²

Acute symptoms occur with inhalation and ingestion of fluorine compounds. Symptoms of non-fatal

fluorine poisoning consist of acute stomach upset with sudden nausea and vomiting; burning in the abdomen and diarrhea. Pulmonary edema is an outstanding characteristic inhalation symptom.⁴ The physiological changes caused by fluorine poisoning are principally blood changes, damage to the lungs, liver and kidneys, and storage of fluorine in the bones. The lungs and liver show the most severe and consistent damage from fluorine absorption.⁶²

When sufficient fluorine is absorbed to be fatal, death may occur in a few minutes or be delayed for ten hours or longer. Alternating spasms and paralysis are present prior to death with general weakness and sluggishness between spasms. There is a fall in blood pressure, general collapse and sometimes the skin shows a grayish-blue coloration. Breathing is difficult and may be arrested. The heart action may also be arrested.

When chronic fluorine poisoning is encountered changes in the teeth are most easily recognized, as fluorine is detrimental to dental growth.⁶² The bone structure is also changed as a result of chronic fluorine poisoning, as fluorine is stored in the bones and teeth. Movement of the spinal column is restricted and parallels the bone changes, which consists of overgrowth of bone and calcification of the ligaments. Bony fragility is also seen in some of the chronic cases. The bony overgrowth tends to disappear when exposure is stopped.⁴

Loss of appetite, nausea, vomiting and heartburn are common symptoms of chronic poisoning. Rheumatic attacks, shortness of breath and circulatory changes are also experienced.⁶²

Skin contacts with fluorine compounds are painful and may lead to deeply penetrating ulcers. The primary difficulty lies in the fact that the fluorine may be on the skin for a considerable period before any of the indications of burning are felt. When this occurs the penetration of the fluorine into the tissue is already deep and the resulting sores continue to eat into the tissue long after the fluorine is supposedly removed from the area, fluorine ion activity being responsible for this reaction.⁹ First aid consists of washing the area thoroughly and applying magnesium oxide paste to absorb the fluorine ions. If further difficulty is encountered a physician should be consulted. The eye membranes also react to hydrogen fluoride and fluosilicic acid, showing slow ulceration of the conjunctivae; the initial reaction being one of excessive lacrimation. Chronic eye reactions consist

of abnormal sensitivity to light and continuous conjunctival secretion. The eyes must be copiously bathed with water and an ophthalmologist consulted immediately.¹⁶

Personal protection consists of wearing air supplied respirators, rubber gloves, shoes, coat, or overalls of impervious neoprene coated material. Respirators or goggles should be of material which does not react to fluorine as ordinary glass is etched by the fluorine containing compounds.⁶²

Neutral Solutions

The neutral solutions in themselves are not harmful from either a corrosion or fire standpoint, but depend upon the nature of either the metal or the anion present to bring about skin or other type reactions. For instance, the nickel baths derive their toxic reaction from the nickel salts present and not from the carrier.

Conclusion

Table II was compiled as a summary of the foregoing material. The references were not included as it was felt that in a First Aid Chart they were unnecessary and would hinder the quick and efficient use of the material included.

While it has been the purpose of this paper to show the toxic nature of the compounds that are used in the plating industry and the possible effects that may result from inhalation, contact and ingestion, it is advisable that a modicum of common sense be applied in regard to such information. Even after having resorted to the best first aid practices, the patient should promptly avail himself of expert medical advice and attention.

When the hazards generally are known, it makes it less difficult to protect against them at their source. Knowledge of the signs of such contacts helps the operator to help himself before too great damage to his health and life can result. It aids management to provide proper equipment, safeguards and education for the workers. This is the primary aim in placing such information in the hands of many.

Papers are now in the process of preparation for early publication which give a summary of the toxic hazards encountered when degreasing agents, solvents and addition agents are handled.

The author gratefully acknowledges the assistance given in the preparation of this paper by Mr. Harold A. Burnson of the Chicago Anodizing Company.

(References appeared in August Issue)

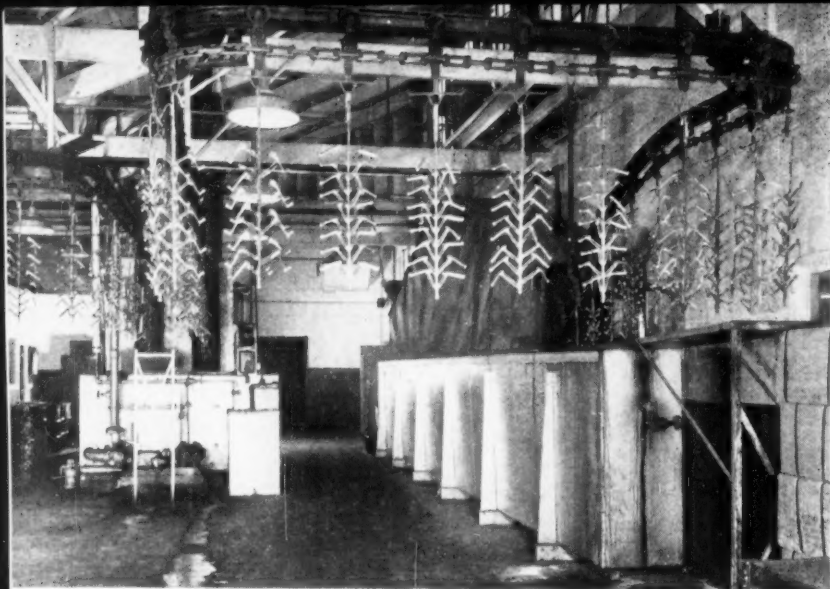


Figure 1. Automatic dip and spray precleaning unit for cleaning die cast zinc base, steel and copper hardware prior to bright nickel and chrome plating.

Metal Cleaning—Methods and Results

By Jas. Rowan Ewing, Asst. to President, Solventol Chemical Products, Inc., Detroit, Mich.

The function of mild alkalis, liquid hydrocarbons, chlorinated solvent vapors, emulsion of hydrocarbon grease solvents and water and multiple-phase type cleaners are explained in this paper. Results of various tests of different types of soil-removing cleaners are given in photographic form.—Ed.

CLEANING prior to plating, phosphate coating or final finishing is a subject receiving more and more attention as the metalworking industry recognizes the importance of this step in the final quality of products. For years specific metal cleaning was not on the engineer's blueprint and as a result the so-called "cleaning" process was usually makeshift and inefficient.

Modern metal cleaning is gaining the stature of a science. A correlated development is the recognition of and provision for two basic classes of cleaning problems: (1) ordinary and (2) quality.

Ordinary cleaning applies to those operations in which finish, tolerances, surface condition and appearances are not controlling factors. Examples include cleaning of rough castings prior to machining, cleaning of heavy framework or parts which do not contribute to the working efficiency or where appearance is unimportant. Quality cleaning, on the other hand, should be specified for all working parts, delicate metal surfaces, precleaning prior to finish or protective coatings, including plating.

For many years quality cleaning was obtained in the metals industry by the ingenuity of men rather than the processes available for use in metal cleaning. This will become more evident as we explore the cleaner types and materials and their applications.

Reprinted from Steel, May 5, 1947.

For a discussion of cleaner types, it is well to classify them first in two divisions: The first group comprises those whose primary function is to remove oxides or perform other stripping operations and to attack the metal surfaces by chemical reaction. These include acid cleaners, strong caustic solutions, and alkaline baths where an electric current is employed. In some cases, these cleaners have been relied upon to remove ordinary soil, but their greatest effectiveness has been in the removal of oxides and defective coatings to produce a uniform etching of the metal surface following other types of cleaning operations.

The second group would include those cleaning materials used for the removal of soil without attacking the metal surface, and it is this class that is covered below. The first of these, and still a very widely used cleaning material, is the mild alkali solution, which has as its principal virtue low cost. Some are satisfactory for what have been called "ordinary cleaning operations." Yet for many years, through ingenuity in industry, alkali cleaning has been employed where quality cleaning was required. To effect passable results, multiple rinsing or washing with mineral spirits or hand wiping was added. The multiple rinses are required to eliminate alkali residue which would tend to increase the atmospheric action on the surface or leave a surface unsatisfactory for inspection and final coating.

The second class comprises the liquid hydrocarbon solvents, such as kerosene, mineral spirits, or standard solvents. These are effective in removing oils and greases. Chlorinated solvents used in the liquid state avoid fire hazard but are more expensive.

During the 1920's chlorinated solvent vapor cleaning was introduced. This method of cleaning found wide application in the metal working industry, chiefly

because the cleaning was done by the clean condensed vapor which was distilled off the body of dirt solvent in the tank by relatively high heat. This feature of the vapor bath led to widespread application despite the high cost of the solvent and the need for special equipment. There is not a cleaning problem in industry to which at some time vapor degreasing was not applied or tested. Where soil on the metal surface consists of light grease or oil with no inert or water-soluble materials, particularly on minute parts, or where the prime consideration is a warm, dry surface, vapor degreasing is most successful.

Next class of cleaners comprises emulsions of hydrocarbon grease solvents and water. Until 1930 all emulsion cleaners were soap emulsions, with little cleaning efficiency. Emulsion-type cleaners, developed since 1930, found wide usage in spray and dip cleaning to remove light soils and inert materials. In these instances a fairly satisfactory metal surface is obtained. Also, most emulsion-type cleaners remove ordinary fingerprint residues and thereby prevent corrosion from this source. In many instances a solution temperature must be maintained at 180° or above to insure any satisfactory results.

It has been definitely proved by laboratory research, however, that emulsion cleaners will not remove a water soluble material, such as fingerprint residue, if it is coated with oil or greasy soil. As a result, rust develops on the fingerprint area subsequent to the cleaning operation.

The emulsion-type cleaner offers the economy of combination with water and removal of most inert and water-soluble materials with, in many cases, the added advantage of some protection against corrosion in connection with light cleaning problems.

Multiple-Phase System

Last and most recently developed cleaner is the multiple-phase type. The result of years of applied research, this is a fundamentally new cleaner, bringing together in one system a composition including organic and inorganic solvents for mixture with water to produce a multiple-phase bath in which an upper layer comprises an unemulsified solvent layer and a lower layer comprises a dispersion or emulsion of organic solvents in the water.

This multiple-phase system may be applied to advantage in ordinary dip cleaning but it is best designed for use in spray washing processes, with the

intake of the pump drawing from the lower phase. The separate phases in this system maintain their character as separate layers in the tank and though mechanically mixed in the spray application maintain their individual character at all times.

Surprising improvement in cleaning is achieved as a result of the use of this multiple-phase system. For example, it is found that a soiled metal surface is not wetted by an emulsion of hydrocarbon in water but is readily wetted by a free or unemulsified solvent. Thus powdered iron disperses readily in the free or unemulsified solvent. Conversely, inorganic soil such as aluminum, carborundum, tripoli etc. are not wet readily by the free solvent but disperse freely in the lower or emulsion phase. Finally, the surface tension of the emulsion phase in the multiple-phase system is less than that of the stable emulsion, and its interfacial tension against oily liquids is also materially less.

A multiple-phase system brings into play a new automatic extraction of soil from the circulated solution. Thus the solution can be used for much longer periods and can absorb a much larger dirt load before throwback of the soil on the work occurs.

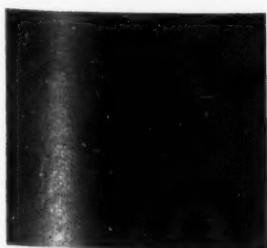
An important feature of this new multiple-phase system resides in the fact that it has the ability to perform functions which neither of the two phases could perform separately or when used in succession. For example, the multiple-phase system will remove a fingerprint deposit which is coated with oil in a single operation, an important result. One of the outstanding characteristics of this new material resides in the protection against atmospheric corrosion which it imparts to the work. Highly finished steel parts are protected against rusting for at least several weeks, even during the humid season.

Test Soft Steel Panels

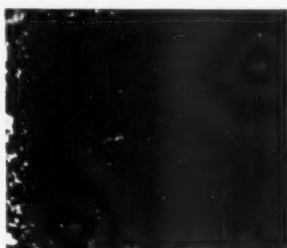
In laboratory tests, soft steel panels with a ground surface resisted rusting for several hundred hours when subjected to a temperature of 100° F and a humidity of 100 per cent, in spite of the fact that throughout the period they were coated with condensation. Apparently the protective agent is in the form of a mono-molecular layer because it cannot be detected by any method of inspection.

Using a multiple phase solution in a 2-stage washing machine, as early as 1940, one major automobile manufacturer cleaned ring and pinion gears, com-

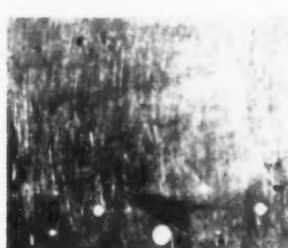
Figure 2. Tin plated test panels dipped in dyed solutions to demonstrate wetting efficiency of multiple-phase cleaning solution and stable emulsion solutions. Compositions prepared with red oil soluble dye.



(a) Multiple-phase solution plus water 1:60.



(b) Multiple-phase solution plus water 1:8.

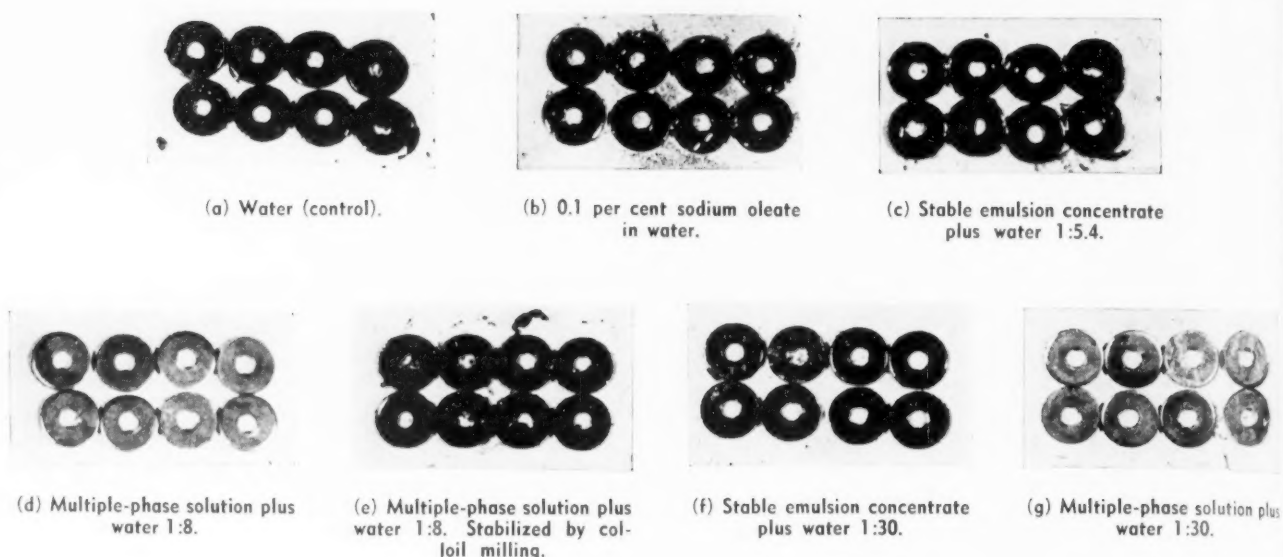


(c) Stable solution concentrate plus water 1:60.



(d) Stable emulsion concentrate plus water 1:5.4.

Figure 3. Disks soiled with umber plus mineral oil, cottonseed oil and oleic acid, agitated with detergent solutions at 130° F.



pletely removing red leads and producing a dry, bright metal surface protected against atmospheric attack. During the latter part of 1939, the problem of combining plastics with metals was met with a multiple-phase solution which provided a metal surface receptive to bonding with plastics. A 65 per cent overall cost reduction was effected on steering wheel inserts.

To the engine manufacturer, the cleaning of pistons posed one of the most difficult problems, and in the aircraft field prior to the war this problem was met only with hand operations. By the application of the multiple-phase type of cleaning, aircraft pistons were thoroughly cleaned in a spray operation, followed by a light air blow-off, thus eliminating all hand washing and wiping for the first time. Since

the widespread plating of die-cast and more delicate metals has developed, precleaning ahead of plating has become a major part of the plating process. With the use of a multiple phase solution, it is possible to remove caked buffing compounds from all types of ornamental die-cast hardware, bringing to the plating cycle a bright part free from oxides or any foreign matter that cannot be easily shed in a light rinse or the customary electric cleaning employed in the plating cycle.

Recent results obtained in the cleaning of cold rolled tin plate are interesting. Under laboratory conditions, with plates taken directly from the rolling mill to obtain uniformity of soiling, minimum cleaning time using a multiple phase wash was reduced to 30 sec., from 2 min., previously.

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Black Brass Oxidizing

Question: We want to get a black on high brass, but the closest we get is a dark brown, and in one batch the colors vary. We have used copper carbonate and aqua ammonium 26% in the solution.

L. L.

Answer: We would suggest the following:

Hydrochloric (muriatic) acid	1 gal.
White Arsenic	32 oz.
Antimony trichloride	20 oz.

Cleaning Brass Parts

Question: We are makers of table lamp bases and same is assembled mostly of brass construction. Our problem is in cleaning these parts in preparation for buffing process. Brass is now received from spinners in an oxidized condition and because of this we meet with difficulty in obtaining the proper sheen when polished.

A. M.

Answer: We recommend the following:

Sulfuric acid	2 gals.
Nitric acid	1 gal.
Water	1 qt.
Hydrochloric acid	1/2 fl. oz.

Handle with care and watch fumes. If work is red or etched add small quantity of sulfuric acid. Rinse thoroughly prior to buffing.

Acid Copper Treering

Question: I am using an acid copper bath of the following formula:

28 oz. copper sulphate
55 oz. sulphuric acid
1 oz. aluminum sulphate

This bath is used in the plating of

baby-shoes, I operate this bath at 80° at 1/4 V. which puts 1 1/4 amperes across the cathode and anode. It takes 12 hours to build up a plate of .002 which is too thin—if I increase my voltage to 1/2 V. to flow 2 amperes, treeing results which ruins the object being plated.

What I would like to know is—how can I increase current to 2 amperes or more to produce a heavier plate without treeing. (2 amperes will produce .004 plate in 8 hours which is satisfactory). Tanks are covered with muslin screens during plating.

W. K. V.

Answer: From your description of the treeing, you are probably having anode polarization trouble. To adjust, the temperature can be increased, air agitation of the solution used and increase in sulfuric acid content or decrease in copper sulfate content made. The effect of air agitation in acid copper solution is very marked, permitting much higher current densities to be used.

Etching on Tin Plate

Question: We are having considerable difficulty finding a fluid for stamping code numbers on tin plated beryllium copper. These numbers, which are subject to water and alcohol, must be permanently stamped on the metal. All fluids used thus far have either washed off or have caused undesirable corrosion.

W. F. H.

Answer: One method is to etch the numbers into the tin plate. This can be done with ferric chloride, or highly diluted nitric acid, washing afterwards with a neutralizing agent.

Stripping Nickel and Copper From Zinc

Question: What stripping solutions can be used which will not affect the base metal of zinc to remove nickel and copper from zinc base die castings?

E. R. D.

Answer: Make work the anode at full line voltage (6 or 8 volts) in 50% to 93% of sulfuric acid. Glycerine in amounts of 1:100 is also added. Copper strips slowly by this method; it is best to cut the copper off by abrasive methods.

Cyanide Copper Plating

Question: We have a Rochelle copper bath in operation in our plant—metal 2.5, free Cyanide 1.3, rochelle salts 4.925, carbonate 3.6 and a pH of 12.6.

We are having difficulty putting on enough copper in 45 minutes of plating to enable us to buff out polish marks without cutting through to the steel.

We are using 3.5 to 4 volts and around 300 amperes and when we use a higher voltage the anode takes on a very discolored appearance, somewhat like the appearance of copper sulphate. We would like information as to why this takes place at a high voltage and if there is any danger of it causing defective plating.

C. S. G.

Answer: With your free cyanide as high as it is, corrosion of the anodes is no doubt taking place too rapidly. Would recommend that you reduce the free cyanide content to 0.75 oz./gal. Would also recommend that you use about 5% insoluble anodes, the rest copper. Your Rochelle salt composition is also rather high; although this is not too serious. Keep the solution between 140-180 degrees F and agitate the work; this should correct the thin coating condition.

Brass Plating Gray Iron

Question: We are brass plating some gray iron castings, and are having a great deal of trouble with the cyanide spotting out from the pores of the castings. How can we overcome our difficulty?

E. T.

Answer: If the castings are of a porous nature, there is not much you can do other than plating the casting with a good heavy coat of copper in an acid solution, then plating brass over the copper by use of the regular cyanide-brass; this generally inhibits spot-out in porous basis metal. It is also possible that you have not prepared the surface properly. If, after the blasting operation, if any, you use a solution of 1 pint sulfuric, 1 pint hydrofluoric and 1 gallon of water, the casting should be quite clean. Also, after the necessary precleaning and rinsing operations prior to plating, you immerse the work in a 3% solution of sulfuric acid, rinse thoroughly, then plate in brass, the condition of the work should be improved.

Cast Aluminum Cleaning

Question: We have a cast aluminum panel which is faced off, placed in hot potash for 5 minutes, dipped into acid, rinsed in cold water, hot water and dried in an oven for one hour at 200° F. Then a lacquer finish is applied to the panel, but I find 10% of them form little blisters while they are drying from little pores in

the casting. We have dried them off in sawdust with even worse results.

G. A. R.

Answer: Evidently the pores in the surface of the metal are causing the blistering. It is possible that your five minute treatment in potash followed by an acid dip is too severe. Generally, aluminum is cleaned prior to lacquering by immersing the work in an almost neutral cleaner for about 30 seconds, then dipping in acid to neutralize the surface.

Electrolytic Pickling of Copper

Question: We would appreciate any information concerning the electrolytic pickling of copper and its alloys.

W. L. B.

Answer: Copper and its alloys are seldom pickled electrolytically, but rather by immersion. Electrolytic pickling is best done in a sodium cyanide bath, 4 oz./gal., with the work as anode, temperature 120 to 150 degrees F.

Plating Room Paint

Question: We intend to paint the walls and ceilings of our plating room. Please advise us as to the type of paint to use that will withstand the usual atmosphere of acids and alkalies contained in a plating room.

N. J. H.

Answer: In general, plating rooms are painted with aluminum-loaded paints to give both fume and corrosion

resistance. A primer loaded with chrome, such as zinc-chromate, is often used, then one to three coats of an aluminum loaded material. Hoods, fans, etc., are of course covered with special materials to inhibit corrosion.

Tin Formula and Silver Recovery

Question: Please tell us the best formula using tin chloride in preparing the tin plating solution. Is the chloride solution best for all round tin plating? Also please tell us an economical method of recovering silver from a cyanide solution that has had pieces of lime and brick thrown in. Can such a solution be restored to use and how?

W. G.

Answer: In general, tin is plated from the tin chloride bath by immersion only. A formula for such a bath is as follows:

Tin chloride	2 oz.
Caustic soda	3 oz.
Sodium cyanide	1½ oz.
Water	1 gal.

Immerse work for about 20 minutes in an iron basket, or use iron hooks. Bath should be boiling. It is recommended that proprietary tin baths be used as these are well controlled in composition, adhesion and brightness.

For recovering silver from a cyanide solution, add three ounces per gallon of zinc dust, in small quantities with thorough mixing. Wash out the sludge formed thoroughly and remove the excess zinc by the use of dilute hydrochloric acid.

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Non-Destructive Thickness Measurements

PURPOSE

To determine the thickness of electroplated coatings by means of a rapid non-destructive test.

APPLICABILITY

Accurate measurements can be made of non-magnetic coatings on a magnetic base, nickel coatings on a non-magnetic base and polished nickel coatings on a magnetic base.

METHOD

The instrument consists of a small permanent bar magnet, freely suspended from a horizontal lever arm which is actuated by a beryllium-copper spiral spring coiled by turning a graduated dial.

The attractive force between the magnet and the specimen is indicated on the graduated dial and is converted to thickness measurements by reference to a calibration curve supplied with the instrument.

PRINCIPLE

1. Non-magnetic coatings on magnetic base

The method is based on the decrease in the magnetic attraction resulting from the inter-position of any non-magnetic material between the magnet and the magnetic base.

2. Nickel coatings on non-magnetic base

Nickel is ferro-magnetic. The attractive force between a bar magnet and the nickel coating is practically proportional to the thickness of the coating.

3. Polished nickel coatings on steel

Nickel is less magnetic than iron or steel and consequently when a nickel coating is present it decreases the attractive force of the magnet. Special calibrations are required but the principle is the same as described for non-magnetic coatings.

ADVANTAGES

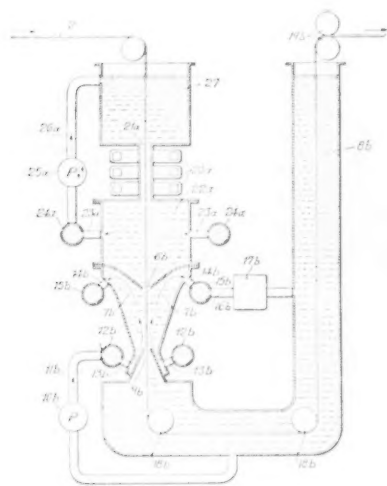
1. Non-destructive; neither the coating nor the base metal is affected.
2. Rapid; measurement is a matter of seconds.
3. Accuracy; within 10% for coatings heavier than 0.0002".
4. Easy to operate; requires no skilled training or evaluation.
5. Instrument is portable and involves no electrical equipment or additional materials.

Patents

Tin Plate Brightening Apparatus

U. S. Patent 2,424,034. Edward William Hopper, assignor to Crucible Steel Company, July 15, 1947.

Tinplate brightening apparatus of the class described having an upper relatively hot liquid containing com-



partment having associated therewith a throated portion affording downward travel of a plated strip or the like through said compartment and throat, a heating unit enclosing said throat and constructed to melt the coating of the strip as it passes such throated portion, a heat trap chamber disposed beneath said throat and in the path of travel of said strip, means being provided to circulate liquid between said chamber and said compartment, said apparatus including a relatively cooler liquid containing compartment disposed beneath said chamber.

Electrolytic Treatment of Tin Plate to Prevent Sulphur Staining

U. S. Patent 2,424,718. Arthur E. Stevenson and Benton Hall Schaub, assignors to Continental Can Company, Inc., July 29, 1947.

The electrolytic method of treating tinplate to prevent sulphide discoloration when contacted with sulphur-containing products, which concludes with treating the same for substantially 1 to 15 seconds at a current density of substantially 10 to 100 amperes per 100 square inches of effective tinplate area as cathode in an

alkaline aqueous electrolyte containing soluble chromate in concentration of $2\frac{1}{2}$ to 25 grams per liter computed as anhydrous sodium chromate, at a temperature of substantially 50 to 212 degrees F. and having a pH of substantially $8\frac{1}{2}$ to 12, said cathodic treatment producing upon the tinplate a surface of clear bright appearance resistant against staining by the sulphur-containing product.

Tin Plating Baths

U. S. Patent 2,424,472. Frederick A. Lowenheim and Martin M. Sternfels assignors to Metal and Thermit Corporation, July 22, 1947.

A process for the electrodeposition of metallic tin which comprises passing electric current from an anode to a cathode and through an electrolytic bath comprising essentially water potassium stannate at a concentration between about 0.25 and about 3.0 mols per liter and free potassium hydroxide at a concentration between about 0.15 and about 3.5 mols per liter, maintaining the temperature of said bath within the range of about 70° C. to substantially the boiling point thereof, maintaining the cathode current density between about 30 to 1,000 amperes per square foot, and operating said process at a cathode efficiency of about 60 to 100 per cent.

Indium Plating

U. S. Patent 2,423,624. Clarence F. Smart, assignor to General Motors Corporation, July 3, 1947

A process of preparing an electrolyte for the electrodeposition of indium which comprises, dissolving tartaric acid in water to make a concentrated solution, dissolving a compound of indium in said solution, and adding water and ammonium hydroxide to the indium containing solution to make an ammoniacal solution of the desired concentration.

Bright Copper Electrodeposition

U. S. Patent 2,424,837. John A. Henricks, assignor to Houdaille-Hershey Corporation, July 29, 1947.

A method of electrodepositing bright and ductile copper, which comprises electrodepositing copper from an aqueous sulfuric acid solution of copper sulfate, there being added to

such solution from 0.1 to 15 g./l. of a water dispersible brightening agent selected from the group consisting of sulfurized sulfonated hydrocarbons containing a six carbon ring and their substitution products in which the ring is nuclearly substituted with an alkyl group.

Cleaning and Pickling of Metals

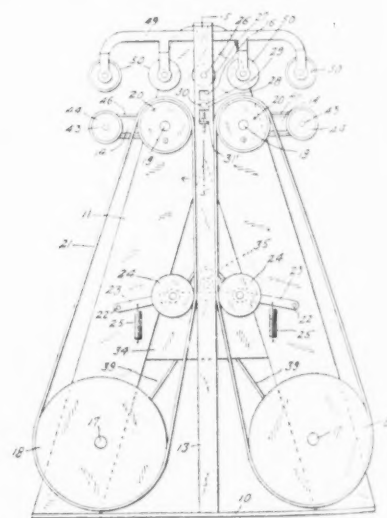
U. S. Pat. 2,425,320. William H. Hill, assignor, by mesne assignments, to Koppers Company, Inc., August 12, 1947.

A cleaning and pickling composition for metal subject to atmospheric corrosion and for removing oxides and other corrosion products from surfaces of said metal, said composition comprising a pickling acid solution having dissolved therein a relatively small proportion of a reaction product of an aldehyde and a preformed thiocyanate of a basic, nitrogenous organic compound having at least one nitrogen-containing radical selected from the group consisting of NH_2 and NH , said reaction product being soluble in said pickling acid solution in a proportion which inhibits dissolution of said metal by said acid.

Endless Abrasive Belt Sanding Machine

U. S. Patent 2,424,044. Harvey L. Miller, July 15, 1947.

In a sander a frame representing in cross-section a substantially inverted



V, at least one pair of closely spaced pressure rolls carried by the frame near its apex, at least one drive roll adjacent the lower end of each leg of the frame, an abrasive belt trained

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AE - PC - LIXOL

• All purpose, low cost washing machine cleaners

B - PS - SM - LIXOL

• Non-clogging steam jenny cleaner GM

• Wire coating compound WC

• All purpose stripper ST

over each pressure roll and each drive roll, means to drive the drive rolls in unison and a pair of feed rolls between the pressure rolls for gripping and moving a piece to be sanded across the belts in a direction perpendicular to the axis of the rolls.

Selenium Rectifier

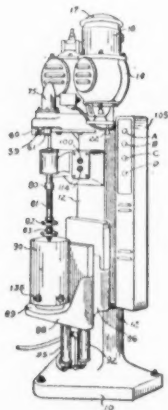
U. S. Pat. 2,426,377. *Cleveland Scudder Smith, Jr., assignor to Samuel Ruben, August 26, 1947.*

In the art of depositing a selenium layer of substantially uniform thickness upon at least one surface of a metal base, the improvement which comprises the steps of vaporizing selenium at substantially atmospheric pressure, forming the resulting vapors into a thin ribbon-like stream in substantially unadulterated vaporized form, surrounding said stream with an envelope of gas selected from the group consisting of reducing gases and inert gases, moving said metal base so as to intersect said stream in a direction perpendicular to the widest dimension of said stream to form a thin, uniform and adherent coating of selenium in the gray, metallic state upon said surface, and repeating said movement back and forth through said stream to form a selenium layer of desired thickness.

Surface Finishing

U. S. Pat. 2,425,640. *Rodman C. Pruitt, Edward F. Fowle and Richard S. Iglehart, assignors to The Steel Products Engineering Company, August 12, 1947.*

A machine for smoothing and removing burrs and the like from an article which comprises a container for receiving a quantity of abrasive in fluid suspension, a support having

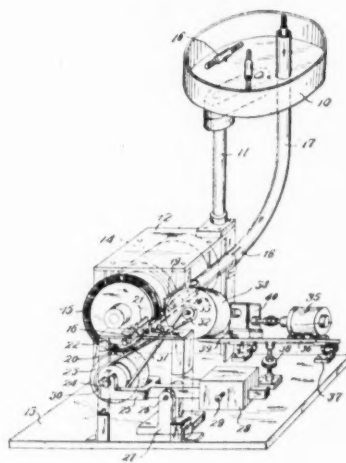


means thereon for receiving the article, means for moving said support with said article attached thereto relative to said fluid suspension for a period of time sufficient to effect the smoothing and burr removal therefrom, and a baffle removably positioned in said container and projecting upwardly in predetermined relation to said article.

Stud Cleaning and Polishing Machine

U. S. Patent 2,424,160. *Elmer G. Greene, assignor to The Ferry Cap & Set Screw Company, July 15, 1947.*

In a machine for cleaning studs and

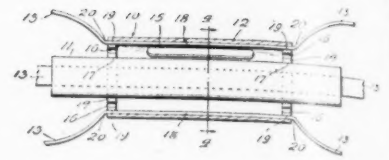


like articles, a high speed rotating brush, an abrasive wheel disposed beneath said brush, a lever having bearings for said wheel, driving means independent of said brush for rotating said wheel at low speed to clean and dress said brush, and adjustable overbalancing means for said lever to yieldingly support the wheel against said brush.

Electrolytic Water Purifier

U. S. Pat. 2,425,424. *Theodore C. Jones, August 12, 1947.*

A self-energizing, electrolytic water correction device comprising a tubular metal casing member constituting a positive electrode, end members secured to the ends of said tubular casing member, resilient strips, extending longitudinally through said tubular casing member and secured between said end members and said casing member, and a negative electrode galvanically cooperable with said tubular casing member, said negative electrode extending longitudinally through said



tubular casing member and being supported by said end members, the ends of said resilient strips projecting beyond said end members and constituting resilient supporting fingers for said device, at least one of the aforesaid members being apertured to admit water into said tubular casing member.

Method of Hardening Metallic Films

U. S. Patent 2,424,043. *Gerard A. Meyer, assignor to Bausch & Lomb Optical Company, July 15, 1947.*

The method of treating a metallic film deposited on a surface of a body in vacuo to increase the durability of the film which comprises the steps of placing the body in an evacuable container with the filmed surface held substantially parallel to the surface of one of a pair of electrodes formed of a material which will not sputter appreciably; evacuating said container to a pressure of about 250-50 microns of mercury; subjecting the filmed surface to a discharge created in the partially evacuated container by a high voltage current passed between said electrodes; discontinuing said discharge after approximately one hour; and immediately thereafter subjecting said body for a period of time substantially equal to the duration of said discharge to storage in an ambient pressure of about 0.1-0.01 micron of mercury.

Anodic Treatment of Magnesium

U. S. Pat. 2,426,254. *Herbert Waterman, assignor to Turco Products, Inc., August 26, 1947.*

The method of electrolytically forming a protective film on a magnesium object which comprises electrochemically treating the object, as an anode, in an electrolyte consisting of a substantially saturated solution of alkali carbonate while maintaining the solution about 50° C., the anodic treatment being continued until the current flow decreases to a relatively small value due to the electrical resistance of the resulting film.

Heavy Duty Soak Tank Cleaner

The Diversey Corporation, Chicago, has recently introduced a new type heavy duty, non-caustic soak tank cleaner, which they claim eliminates many solvent pre-soak and hand-wipe operations.

Diversey No. 99, as it has been named, is especially designed for heavy duty soak tank cleaning of iron, steel, copper, brass, magnesium and zinc alloys. Being free of caustic soda, it is said to be very popular with workers.

Literature and complete information is available by writing to the Diversey Corporation, Dept. MF, 53 W. Jackson Blvd., Chicago 4, Ill.

Liquid Coloring Composition

The Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J. announces the development of a new liquid coloring composition for coloring nickel, brass, copper, aluminum and zinc die castings. The product is known as Acme Grade 4-L-10.

The development of 4-L-10 is the result of months of research. It cleans up beautifully on the work, it leaves the face of the buff soft and clear and it does not clog fluid lines, it is claimed.

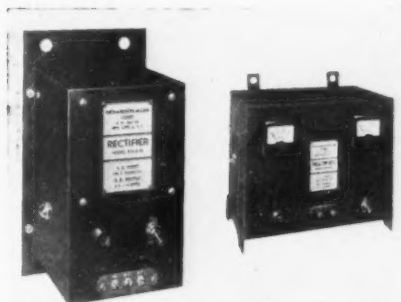
Acme 4-L-10 is recommended for use with pressure type composition spray equipment. For further information write the manufacturer as above.

Small Selenium Rectifiers

Richardson-Allen announces the addition to their line of two new small selenium variable platers designed especially for jewelry manufacturers and laboratory work.

Model D-513A is a 4 Ampere, 6 Volt rectifier that operates on 115 AC single phase 50-60 cycle current. Its dimensions are 7.5" x 4.5" x 5" and is compactly designed for bench or wall attachment.

Model D-514A is a 10 Ampere, 8 Volt rectifier that operates on 115 AC



single phase 50-60 cycle current. Its dimensions are 8" x 10" x 6". This small compact rectifier includes a voltmeter and ammeter.

For complete information and prices, write the Richardson-Allen Corporation, Dept. MF, 15 W. 20th St., New York, N. Y.

Corrosion Resistant Pipe

Announcement of the development of a new type of corrosion resistant pipe and fittings was made by the plastics division of The Dow Chemical Company recently. The company will fabricate the new pipe at its Midland plant.

The product, Saran-lined pipe designed to convey corrosive liquids, combines the desirable features of steel pipe—rigidity and pressure strength—with Saran's extreme resistance to chemicals.

Main use of the pipe is in manufacturing chemicals, and in plants such as pulp, paper and textile; metal

treating and metal plating, where manufacturing methods necessitate handling highly corrosive chemicals, particularly acids.

Saran-lined steel pipe is said to be resistant to a very wide range of chemicals, oils and solvents. It will satisfactorily carry corrosive sulphuric, hydrochloric, nitric and phosphoric acids. The working temperature of the pipe, important to chemical engineers, ranges from 0° to 190°F. depending upon service conditions.

Pipe in maximum lengths of 10 feet and in sizes from 1 to 4 inches will be manufactured. Fittings, also Saran-lined, include elbows and tees, companion and reducing flanges and gaskets. The latter are made of specially compounded Saran to assure maximum chemical resistance at joints.

Field assembly presents no undue problems. Conventional power tools may be used for cutting and threading and assembly of joints is very similar to that of standard steel piping, the company reports.

Belt Polishing Backstand Idler

A recent development in the equipment field is the Niederst backstand idler, designed to give maximum efficiency in belt polishing.

An 8" diameter, 6 1/4" wide, statically and dynamically balanced aluminum pulley is said to give smoother running characteristics and facilitate the use of any width belt up to 6". A specially designed shock absorber is mounted on the stand to eliminate any shock to the machine if the belt breaks. In addition it applies tension gradually to the spindle wheel upon starting. A counter-weight provides belt tension and the idler has both angular and lateral adjustments by means of levers located on the lathe.

For complete information, write Niederst Company, Dept. MF, 3506 S. Michigan Ave., Chicago 15, Ill.





footnote on good shop-keeping

* If you want to keep your shop looking clean, start from the floor up. Use Wyandotte Zorball, the *all-purpose* floor absorbent, to remove oil, grease and other liquids quickly and efficiently.

Zorball gives an immediate anti-skid surface to soiled floors, thus reducing the danger of slipping accidents. And it is nonflammable. Even when soaked with oil, it will not readily support combustion.

Another important advantage of Zorball is that it's thoroughly

safe. It is harmless to fabrics, metals and rubber, and will not irritate the skin of those who handle it.

Your Wyandotte Representative will be glad to demonstrate the effectiveness and economy of Wyandotte Zorball at your convenience. Why not give him a call today?



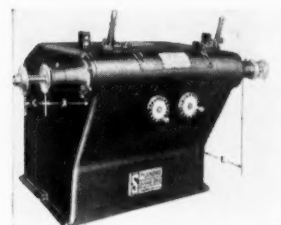
WYANDOTTE CHEMICALS CORPORATION

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Variable Speed Buffing Lathes

The Standard Electrical Tool Company, Dept. MF, 2503 River Road, Cincinnati 4, Ohio have been producing Infinitely Variable Speed Buffing and Polishing Machines since 1938 and now announce that their Type R2V, formerly confined to either two 5 H.P. or two 7½ H.P. motors, is available with two 3 H.P. or two 10 H.P. motors.

Each side of the Type R2V has its own spindle which is individually



operated, permitting each workman to be independent of the other. The equipment on each side of the machine consists of the ball bearing motor, magnetic starter, push button station, hand brake with coincidental switch for simultaneously stopping the spindle and shutting off the current; two "Speedial" controls.

The design is comfortably compact as the measurements of the base is 32" x 30". The "E" dimension provides for a 13" overhanging type of base.

Turning of the "Speedial" control instantly changes the spindle speed which is recorded on the dial. Speed range is from 1500 to 3000 R.P.M. The correct speed is instantly available for buffing, polishing, coloring, etc., maintaining uniform finish throughout wheel life. This reflects in maximum use of wheels, lower production costs and higher production.

Polishing Wheel Cement

Claimed to give decreased set-up costs and improved adhesion, Iding Polishing Cement is said to replace completely the ordinary glue used in setting up polishing wheels.

The material is made of minerals and is furnished in an air tight container from which it can be used directly. Inasmuch as it is a cement, it is claimed to set permanently instead of sticking, as does glue. A sizing head is applied as in the normal operation; it is allowed to dry for an

hour, whereupon the cement is applied by brush and the grain rolled into the wheel for as many coats as desired. Drying is said to be complete in 1 to 4 hours at 125 degrees F, depending upon the number of grain coats used, or 12 to 24 hours at room temperature.

For further information and sample, write M. P. Iding Disc Grinding Compound Company, Inc., Dept. MF, 3420 W. Pierce St., Milwaukee, Wisc.

Periodic Reverse Current Electroplator

A process for electroplating which is claimed to markedly reduce polishing costs as well as provide an electrodeposit of great smoothness, increased density and decreased porosity is announced by the Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J. This new contribution to the field of electroplating is an engineering development of the Westinghouse Electric Corporation and involves periodic reverse plating cycle in which the plating current is reversed briefly at short periodic intervals. Better plate distribution and thicker than normal deposits are said to be obtained at higher current densities than are generally used.

The Hanson-Van Winkle-Munning Company is now prepared to issue licenses for the PR Process as well as to engineer complete industrial installations involving the use of this process.



Laboratory study has shown that excellent results may be obtained with high-speed copper cyanide baths using a five-second plating to one-second deplating cycle. However, in commercial practice it has been shown that a 20-4 second cycle, as well as cycles intermediate between this and the 5-1 second cycle, are quite satisfactory.

The PR Process is also stated to have advantages when applied to the



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Among America's leading industries . . . and in foreign countries over the globe . . . GRIPMASTER leads the way to new profits from polishing. *Do this now.* AT OUR EXPENSE, discover for yourself how GRIPMASTER (with its secret high-heat resisting ingredient) can increase your production . . . give you far more pieces per head! Clip coupon below. Send for generous free sample today!

One grade grips ALL grains—300 to 20

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MF10

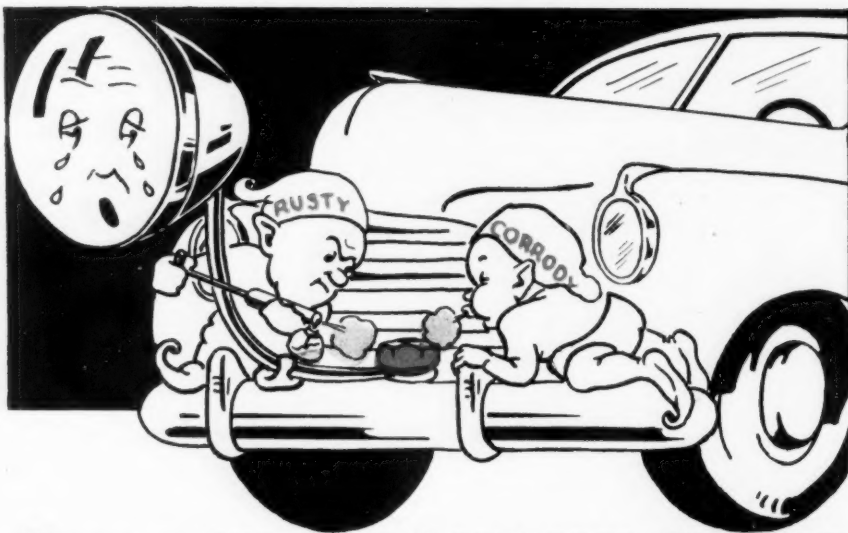
H-VW-M Amine Copper Process to the extent that higher current densities may be used and improved deposits may be obtained. Early experimental work indicates that the process is also applicable to acid baths such as the conventional nickel baths.

Equipment available at the present time consists of an electronic time-contact unit capable of handling up to fifty amperes with a range of a fraction of a second to twenty-five seconds for each portion (anodic and cathodic) of the time cycle. Other H-VW-M PR Controllers designed to carry a thousand amperes or more, are now under test and will be available in the very near future.

Sediment Removal and Transfer Conveyor

For automatic removal and transfer of sediment from settling tanks without removal of fluid, a new mechanism known as the "Houdaille Conveyor" is being marketed by Honan-Crane Corporation, manufacturers of oil purification and clarification equipment.

The Houdaille Conveyor is basically an endless link-chain, motor-driven, on which 4-inch neoprene rubber flights are mounted at 6-inch intervals. It operates through the V-bottom of the settling tank, trapping the sediment between the flights and conveying it



Does a RUSTY and CORRODED FASTENER spoil your product quality?

Rust and corrosion play hob with a product's quality when they're allowed to step in and go to work on untreated fasteners. If you're faced with this kind of a problem, then Luster-on* is your answer.

Nuts, bolts, screws or wing-nuts, basket or barrel zinc-plated and treated with Luster-on*, are permanently brightened, made positively rust- and corrosion-resistant. Once Luster-on* dipped, there's no danger of their spoiling the over-all beauty and utility value of your product.

Luster-on* gives fasteners of every kind a bright new lease on life. Send the coupon and a sample for processing today. See the results for yourself. There's no obligation.

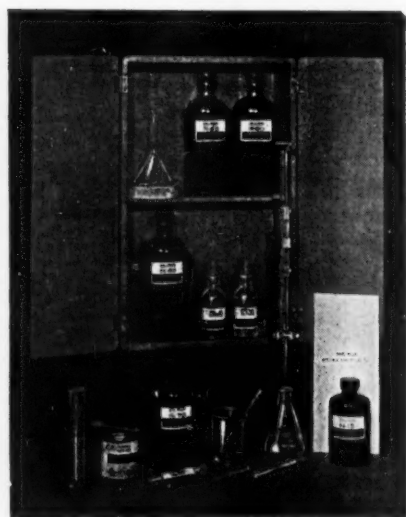
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*REG. U. S. PATENT OFFICE



THE CHEMICAL CORPORATION
54 Waltham Ave., Springfield, Mass.
Please send me full particulars about Luster-on* bright dip for zinc-plated surfaces. I am (am not) sending sample for free dip. No obligation, of course.
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Metal Finishing—October



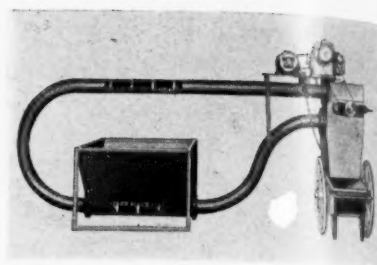
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through a 4-inch pipe-line to a collection and disposal point. The conveyor turns sharply upward upon leaving the tank, thus allowing fluid to drain back. Sediment is carried along to the dumping point where the chain and flights emerge from the pipe and discharge the load while making a vertical turn on the drive-sprocket. Drive sprocket is mounted at the top of the collection hopper. The chain is pin-connected so that it can turn in any direction and thus follow any pipeline course which may be necessary in the specific installation. The conveyor is driven through a chain-and-sprocket transmission from an electric motor and gear reduction case. The speed of operation is about two to three feet per minute.

The conveyor was originally developed to remove chips and sediment from settling tanks which form a portion of central purification systems for cutting oils and coolants used in metal-machining operations. However, it is equally suitable to any application in which it is desirable to remove sediment from a settling tank continuously, automatically and efficiently without removing the fluid.

For complete information write Honan-Crane Corporation, Dept. MF, 650 Wabash Ave., Lebanon, Indiana.

All Metal Pallet Rack

A new, all-metal, single-face pallet rack and nesting ring for use with power or hand truck is announced by Palmer-Shile Company, 12651 Mansfield Ave., Detroit 27, Mich. This



pallet rack can be furnished with nesting ring permanently welded to pallet, if specified.

The pallet rack is especially designed for heavy industrial use, and may be built to suit specific requirements or load specifications. All Palmer-Shile pallet racks are of special rolled channel steel with reinforced, all welded channel support to permit easy handling of excessively heavy loads and is claimed to be ideally suited for rapid handling of heavy irregular shaped pieces or parts of various sizes. Sturdily constructed steel legs provide adequate height to permit complete accessibility from all four sides. Each pallet rack is finished in air-dry enamel.

Manufacturers' Literature

Pocket Size Plating Booklet

A small compact pocket size 28-page booklet containing abstracted chemical information for platers has recently been made available by the J. C. Miller Company.

Information contained in the booklet includes the standard copper, nickel, zinc and cadmium solutions; tables on current efficiencies, electrochemical equivalents, metal content of plating salts, thickness of electrodeposits, rectangular tank capacity, conversion tables, decimal equivalents.

Copies of the booklet are free. They may be had by writing the J. C. Miller Company, Dept. MF, 55 Mt. Vernon N.W., Grand Rapids 4, Mich.

Buffing Composition

An attractive new 16-page booklet on polishing and buffing compositions is available from *The Buckeye Products Company*.

Listing their complete line of compounds, the booklet is profusely illustrated with applications. The compounds are listed under the type of basis metal being worked, and information as to the type of finish obtained is given.

To obtain a copy, write The Buckeye Products Company, Dept. MF, 7020 Vine St., Cincinnati, Ohio.

Contact Wheels for Abrasive Belt Polishing

A new bulletin describes improved



HOW MUCH IS A SQUARE FOOT OF PLANT SPACE WORTH?

\$ 10 ☐
100 ☐
1000 ☐
MORE ☐

BEING AN INVESTMENT, every foot of space in your plant *must* yield a good return.

In the cleaning department this is especially important because production is routed through this space at least once—perhaps several times. There must be no bottleneck.

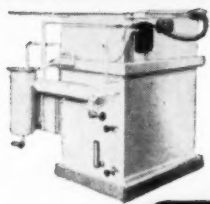
Detrex standard degreasers and parts washers—some hand-operated, some conveyORIZED—fit into any production line setup. For the most economical, efficient, and rapid metal cleaning in the floor space available, consult a Detrex field representative today.

PERM-A-CLOR and TRIAD, vapor degreasing solvents, and TRIAD alkalis and emulsions, give trouble-free performance.

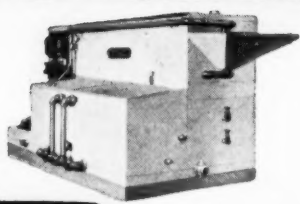
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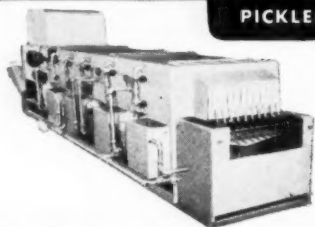
For **DEGREASING • WASHING** **RINSING • PICKLING** and **DRYING** of **METAL PARTS**



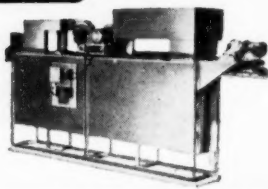
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Standard and Special Types of equipment from the smallest to the largest sizes for a wide variety of metal degreasing, washing, cleaning, rinsing, pickling, drying and allied process operations.

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Engineers and Manufacturers

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OPTIMUS® EQUIPMENT

FOR CLEANING • RINSING • DEGREASING • PICKLING AND DRYING OF METAL PARTS

Neoprene Contact Wheels of special design, made in a wide range of densities and sizes. The various densities are said to adapt abrasive belt polishing to a much greater variety of work than formerly.

Copy of *Presto Bulletin* 105 mailed promptly on request to the Mander-scheid Company, Dept. 100-MF, 810 Fulton St., Chicago 7, Ill.

Corrosion Resistant Materials

Bulletin K describing their complete line of corrosion resistant materials and equipment has recently been released by the U. S. Stoneware Company.

Included are full descriptions of the properties of synthetic rack and tank coatings for handling corrosive liq-

uids, ceramic and metallic materials for extreme corrosive fluids, equipments fully lined with corrosion resistant materials, together with recommended applications for all of these products.

This instructive 16-page bulletin may be had by writing the U. S. Stoneware Company, Dept. MF, Akron 9, Ohio.

Bufs and Compositions

A new folder illustrating their complete line of buf s and buffing compounds has been made available by *The Udy lite Corporation*.

Single-fold, doublefold and bias buf s are illustrated for cool operation, as are the various specially sewed buf s for cutting, buffing and coloring. In

addition, various other wheels for polishing applications are listed. Buffing compounds are described, including the coarser burring compounds, emery cakes, tripolis, grease sticks and special materials for buffing and coloring.

For further information write The Udy lite Corporation, Dept. MF, Detroit 11, Mich.

Die Cast Finishing

A 16-page catalog describing die casting activities of *The Electric Auto-Lite Company* at Woodstock, Illinois, is now available.

The catalog describes Auto-Lite's complete facilities for machining, finishing and plating all zinc or aluminum die cast parts as well as its ability to assist in adapting product design to die casting practice.

Catalogs can be obtained by writing The Electric Auto-Lite Co., Dept. MF, Woodstock, or at Auto-Lite's offices at 600 Michigan Ave., Chicago 5, Ill., and 723 New Center Building, Detroit 2, Mich.

Pickling and Neutralizing Procedures

How certain specialized acid inhibitors and neutralizing materials promote cost-savings and improved-quality production in the pickling of iron and steel is the subject of a special, illustrated service report recently published by *Oakite Products, Inc.*, New York.

This report provides valuable data on this manufacturer's pickle control materials used in the pickling of high and low carbon and alloy steel bar, round, sheet, tube and wire stock. Among the important advantages claimed for these specialized pickle controls are: (1) they save metal; (2) save acid; (3) lower production costs; (4) reduce obnoxious fumes; (5) eliminate over-pickling; (6) reduce hydrogen embrittlement, and (7) provide cleaner work.

A feature of this report is a special section containing graphs showing the action of these Oakite acid pickling inhibitors in reducing metal loss. A comparison chart and table show how these materials reduce acid consumption and extend life of pickling solutions by lowering iron sulphate build-up. Supplementary data includes instruction for making up, controlling and maintaining sulphuric acid and

hydrochloric acid pickling solutions. Report also stresses the importance of neutralizing materials in protecting pickled surfaces against rust, and in removing smut, streaks and stains so as to improve surface appearance and facilitate subsequent fabricating operations.

Industry personnel and other readers desiring a free copy of this service report should address their requests to Oakite Products, Inc., Dept MF, 118 Thames St., New York 6, N. Y.

Buffing and Polishing Machines

The Standard Electrical Tool Company have available their new 16-page catalog B-10 illustrating their line of heavy duty and extra heavy duty buffing and polishing machines, sizes ranging from 1/2 h.p. to 60 h.p.—also the very popular line of *Infinitely Variable Speed* buffing and polishing machines with the *Speedial* control which permits instantly obtaining whatever speed desired between 1500 and 3000 r.p.m.

To obtain a copy, write The Standard Electric Tool Company, Dept MF, 2503 River Road, Cincinnati 4, Ohio.

Mounted Wheel Method Handbook

Practical methods for increasing production, improving workmanship and reducing costs with light portable grinding equipment are described in *Mounted Wheels*, the new 32-page illustrated handbook just published by The Carborundum Company.

The wide range of wheel shapes and



sizes, the variety of abrasives and coated abrasive discs, sleeves and cartridge rolls available for use on light-weight, high-speed portable grinders are discussed and depicted. Photographs and diagrams are used in the booklet to provide correct identification and selection and to illustrate careful handling and storing and to show proper and efficient applications.

This booklet explains how best results may be attained by users of light, high-speed machines for all types of grinding. These operations range from rapid stock removal jobs to work requiring exact precision and high finishes. It tells the abrasives that should be used for grinding cast iron and plastics, high-speed and alloy steels, brass and bronze, aluminum and annealed malleable iron. It shows mod-

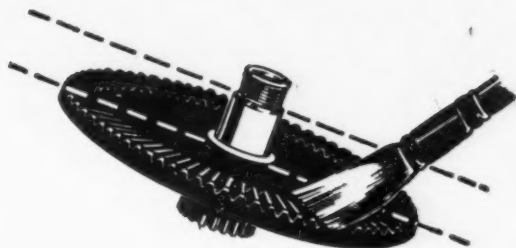
ern industrial production operations with portable equipment grinding centerbores in steel plates, chamfering steel stamping dies and finishing the walls and curved ends of an aluminum casting.

Mounted Wheels is a companion piece to the highly regarded series of technical and engineering informative literature which the company has published as a service to industry. Copies may be obtained from your Carborundum representative, or by writing The Carborundum Company, Dept MF, Niagara Falls, N. Y.

Index to 1946 A.S.T.M. Standards

Index to A.S.T.M. Standards, as of December, 1946, issued in June, 1947,

UNICHROME stop-off lacquers



**Help you do a better job
... in less time!**

EASILY APPLIED—by brushing, spraying or dipping—these tough synthetic lacquers assure clean-cut edges, withstand hot cleaners and acid dips, and will not contaminate plating baths.

FAST DRYING—in 5 to 10 minutes, at room temperature.

QUICKLY REMOVED—by peeling off or dissolving in remover solution, depending on type of stop-off used.



Stop-off 322 (Black)
Extra adherence for severe cycles, including hot cyanides. Removed by dissolving in Remover 322-RA.

Stop-off 323 (Red)
For Chromium and other moderate-temperature cycles. Readily peeled off at room temperature.



Stop-off 324 (White)
For all high temperature solutions. Resists hot alkaline cleaners, vapor degreasers for limited time. Easily peeled off while warm.



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Special jobs and difficult jobs are easily handled in Blakeslee Solvent Vapor Degreasers. The inside of tubing up to 40 feet long with a diameter as low as $\frac{1}{8}$ inch may be thoroughly cleaned and dried.

Blakeslee Degreasers insure cleaning of all surfaces, cracks, spot welded seams; preventing bleeding of oil from hidden surfaces. This complete cleaning eliminates carry over of oils and greases to acid and plating tanks, and does away with rejects resulting from inferior cleaning methods. Removal of polishing and buffing compounds is another perfect application of Blakeslee Degreasers.

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NEW YORK, N. Y. TORONTO, ONT.

BLACOSOLV
DEGREASERS AND SOLVENT

NIAGARA
METAL PARTS WASHERS

is really an adjunct to the 1946 *Book of Standards* and enables any of the some 1400 standard specifications and tests in the volumes to be located readily. The Index is also of service to those who wish to determine whether A.S.T.M. has issued standard specifications, test methods, or definitions covering a particular engineering material or subject.

All items are listed in the Index under appropriate key-words according to the particular subjects they

cover. As a convenience a list is given of the specifications and tests in numerical sequence of their serial designations.

Copies of the 242-page publication are furnished without charge on written request to A.S.T.M. Headquarters, Dept. MF, 1916 Race St., Philadelphia 3, Pa.

Protective Coating and Lining

An entirely new brochure on protective coating and lining for steel and

other metals is now available from *Lithgow Corporation*, Dept. MF, 333 W. 40th Place, Chicago 9, Ill.

Lithcote baked-on synthetic resin coatings and linings are designed for staying qualities against acids, solvents, brines, alcohols, fats, oils, syrups, petroleum, etc.

Described in this illustrated, eight page catalog are a wide range of applications, plant and field facilities, research and actual names of users. Report of actual laboratory tests are also included. These show the results of suspending Lithcoted strips of mild steel at room temperature in various solutions, such as inorganic and organic acids and compounds, also results of special tests.

The Lithcote catalog may be obtained by writing the manufacturer as above.

Letters to the Editor

Metal Finishing,
11 West 42nd Street,
New York 18, N. Y.

Dear Sirs:

We thank you for your letter of August 15th together with tear sheets of article entitled "Practical Methods in Heavy Industrial Nickel Plating", also for making no charge.

The article was very interesting, especially to the writer who helped to develop the process in 1916 in the British Royal Flying Corps at an engine repair shop in France.

Since then the process has been developed over here on very much the same lines as explained in your article and was very widely used during the last War.

Again thanking you for your prompt attention

We remain,

Yours faithfully,

THOMAS TRY LIMITED.
Hanwell, London, W. 7.
H. Lovelock, Director.

Metal Finishing
11 West 42nd St.
New York 18, N. Y.

Gentlemen:

Regarding shop problem signed J. A. S. (incidentally why not number these) I wish to offer the following re-

sults of experience I have had in cutting down spoon-shaped fishing spinners. These were handled in a No. 1 Baird Barrel in a solution of soluble oil and an abrasive. The parts had a tendency to stick together due to shape and also to the consistency of the cutting mixture. To overcome this a few handfuls of No. 20 sifted hardwood sawdust was put in the barrel when loading. The particles of sawdust lodged between the parts and prevented the vacuum that would otherwise form. A few would still stick together but only a very small percentage of the whole.

The barrel as you know is of the horizontal type and as your subscriber does not state what type he uses and as I do not know the size or nature of the piece he is finishing, I do not know if the information offered him will be of value as I feel that if he is using an oblique type barrel with water the sawdust will probably rise to the surface. However, if his parts are cup shaped he may be able to get good results from using a very coarse grade of ground corn cobs mixed with his pumice and water and parts.

If the above suggestions help solve your subscriber's problem I would be interested in hearing of the results.

Yours truly,

A. A. Mercil
Route No. 1
Foey, Alabama

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

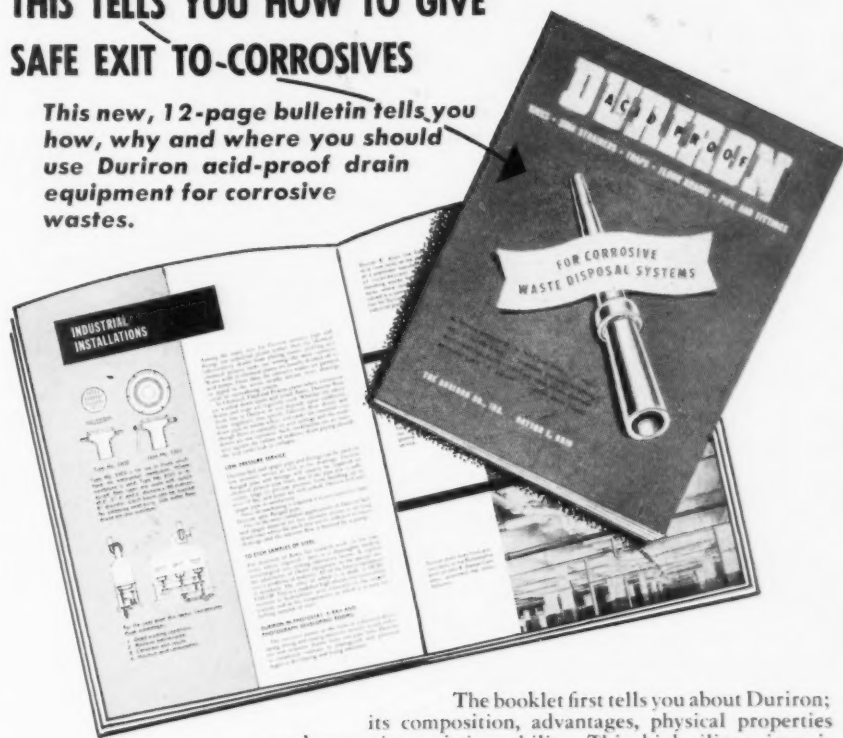
Melbourne Branch

June Meeting: A general meeting, presided over by *Vice-President A. B. Pritchard*, was held at the Chamber of Manufactures at 8 p. m. on the 23rd of June, when the president, *Mr. J. J. Dale* lectured most ably on "Electropolishing." Some forty members and visitors attended and evinced great interest in the paper presented and the discussion which followed. Particular reference was made to electropolishing stainless steels, pure aluminum, and nickel.

In the business session preceding the lecture, *Secretary L. Francis* presented a brief account of recent correspondence conducted with U. S. A. relating

THIS TELLS YOU HOW TO GIVE SAFE EXIT TO-CORROSIVES

This new, 12-page bulletin tells you how, why and where you should use Duriron acid-proof drain equipment for corrosive wastes.



The booklet first tells you about Duriron; its composition, advantages, physical properties and corrosion-resisting ability. This high-silicon iron is compared with other materials and its superiority for handling corrosives is shown in dramatic visual form.

A handbook on Duriron drain line material for handling corrosive wastes, the bulletin gives engineering data, sizes, dimensions and drawings of the various pieces of Duriron equipment . . . instructions on how to install . . . information on application in chemical laboratories, industrial installations, engraving plants and other places where corrosives are handled. Installation photos and a partial list of existing installations in various types of plants are also included.

Today's high cost of repairs makes the Duriron drain line installation even more economical than ever.

Find out how you can protect your waste disposal system against costly corrosion. Write for this new, free bulletin today. Ask for Bulletin 703.



THE DURIRON CO., INC. • DAYTON 1, OHIO

DURCO Adv. 47-GM

Branch Offices in Principal Cities

to the proposed revision of the Society's constitution.

July Meeting: The regular monthly meeting was held on 28th of July at the Chamber of Manufactures. This was preceded, as is usual practice, by a committee meeting held at 4:30 p. m., following which committeemen adjourned to a nearby hostelry to revive their spirits after a rather dry session and, incidentally, to dine. This is mentioned because of the remarkable recuperative effect careful scientific ministrations had on *Mr. Keith Leigh* who was the speaker for the evening. *Mr. Leigh* had suffered badly from laryngitis-cum-pharagitis-cum-what-may during the committee meeting, but made a splendid recovery to pre-

sent an interesting and clear account of "Ohm's Law and Its Importance to Platers" at the general meeting.

This provoked *Mr. Dale* to challenge all and sundry to show why, if the dire necessity were forced on us, it would not be better to discard the voltmeter rather than the ammeter. This challenge was, of course, intended to initiate discussion, and it succeeded admirably. *Mr. A. H. Chesterfield* made suitable remarks defending the usefulness of the voltmeter, especially as an indicator of healthy or unhealthy conditions in plating solutions and electric circuits generally. Other members referred to the importance of voltage in black nickel plating, and to the conclusions which can be drawn if



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To speed up operations and still maintain the finest finishing results in both metals and plastics, use a standard or a custom produced McAleer Composition.

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Insures uniformity
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Automotive-Household-Industrial
FINISHING MATERIALS
ROCHESTER, MICHIGAN

the voltage jumps, for instance, in alkaline tin plating or cadmium plating circuits. In general, the lively discussion indicated that the meeting agreed with the contention that the ammeter was of greater use, but considered the voltmeter very useful indeed.

Los Angeles Branch

The first fall meeting of *Los Angeles Branch* of the *American Electroplaters' Society*, held on the night of September 10 at Scully's Cafe, attracted an attendance of 100 members and guests.

The educational session was featured by a talk on "*Perflow and New Methods of Electroplating Nickel*" by Herold Kroesche of the Harshaw

Chemical Company. Mr. Kroesche presented a brief historical background on nickel plating as the prelude to an extensive general discussion of new methods.

Fourteen new members were initiated in a streamlined initiation ceremony introduced for the first time at this meeting by *President Howard Woodward*. The new members are the following:

Alfred E. Clenard, Sta-Chrome Plating Company, Glendale; *David M. Devon, Jr.*, United Mfg. Company, San Diego, and *John A. Hudson* of the same firm; *Harold L. Preston, L. H. Butcher Company*, Los Angeles; *Harold A. Claus*, Slack-Dorner Brass Company; *Marvill J. Beall*, Mineral Mining Company; *Charles B. White*,

General Chemical Company; *James D. Mason*, Adams Rite Mfg. Company, Glendale; *Eugene Neale*, Gene's Plating Company; *Robert Richards*, Richards Rack Company; *John Hunter*, manufacturer's agent; *Roy Stetson* and *Clarence R. Possell*.

Don H. Bedwell, *Leo Atimion* and *Jack Raskin* presented reports on the Supreme Society convention. Bedwell reported from the standpoint of convention procedure, proposed constitutional changes and general activity; Atimion from the standpoint of side-light events and visits to Detroit plants; and Raskin told of new developments and technical discussions that took place.

In view of the delegates' reports that Supreme Society conventions have been assigned as far ahead as 1951, Los Angeles Branch has decided to withdraw from any competition for holding the national convention in Los Angeles for some years to come.

Earl Coffin was named general chairman of the branch's 1948 educational session committee, with authority to name his own assistants. The session will be held some time in March, 1948, at the Los Angeles Breakfast Club.

Mike Raskin reported that a new semester in a series of classes on electroplating sponsored by the University of California at Los Angeles was to begin at Woodward College in downtown Los Angeles on September 23. The course, he reported, will consist of lectures on the fundamentals of plating and polishing presented through guest lecturers, as well as special subjects and visits to outstanding plating shops in the Los Angeles area. The class will meet every Tuesday at 7 p.m. for 18 weeks.

Attention was also called to the fact that a night school class on chemistry relating to the plating field will be available at no cost at Polytechnic High School, Los Angeles, under the auspices of the Los Angeles Public School System.

THE ELECTROCHEMICAL SOCIETY

Boston Convention

The *Electrochemical Society*, an international organization devoted to the advancement of theoretical and applied electrochemistry, will hold its fall convention in Boston, Mass., on October 15-18, 1947.

A full day will be given to the presentation of papers pertaining to batteries. The recent war stimulated an increased activity in this field which no doubt will continue. New developments in both primary and storage batteries will be described by manufacturers and users. *Dr. John N. Murgich* will preside.

A half-day's session will be devoted to high temperature products. *Mr. James H. Critchett* will be in charge of this meeting. Among the several interesting subjects which will be discussed are the metallurgy of malleable zirconium and the production of fused silica. Both of these contributions are from the *U. S. Bureau of Mines*.

The preparation of chemical compounds by electrochemical processes will be discussed in two half-day's sessions, one devoted to the "per salts" and the other to electro-organic syntheses. The first will be presided over by *Dr. Ralph M. Hunter*, the second by *Dr. N. M. Winslow*. A total of fourteen papers will be presented by recognized authorities in this rapidly expanding field.

Electrochemical methods of laboratory control will be considered in a half-day's session presided over by *Dr. Eric A. Arnold*. A number of important advances will be described by well-known authorities.

A testimonial dinner and dance in honor of *Dr. Colin G. Fink*, retiring Secretary of the Society, will be held on Thursday evening, October 16th.

Timely topics of general interest will be treated by noted guest speakers at two of the luncheons. On Thursday, *Dr. J. B. Fisk*, Director of Research for the *U. S. Atomic Energy Commission*, will discuss "Some Problems of the Nuclear Chain Reactor". On Friday, *Mr. Erwin D. Canham*, Editor of the "Christian Science Monitor", will discuss "Our Pacific Frontier with Russia".

News from California

By Fred A. Herr

L. H. Butcher Company Equips Two Los Angeles Laboratories

The *L. H. Butcher Company* has equipped two laboratories for providing service to the metal finishing trade of the West Coast as part of the facili-

NEW UNICHROME IT'S HERE RACK COATING



with 100% SOLIDS

It's READY for you now—Coating 218—the last word in rack coatings if you want a job that lasts, saves money and is quickly done. Here's why:

NO THINNERS! You get all *working* material in Coating 218. Nothing to evaporate, nothing to replace, no fire hazard.

FEWER COATS! Only *one* main coat is required over prime and "tie" coat. It goes on *smoothly* over all—in a coating that's far thicker than *eight* coats of solvent types!

QUICKLY APPLIED! Racks are ready in less than $\frac{1}{4}$ of the time ordinarily needed. You do the job in about 2 hours with Coating 218.

SUPER TOUGH! Elastic Unichrome Coating 218 won't tear or chip, blister or lift. This scuff-proof jacket stays sleek and smooth through toughest plating cycles!

Get the complete details. Write your nearest Unichrome office for our 4-page bulletin.



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RACK COATINGS—Products of

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Detroit 7, Mich. • Waterbury 98, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal

ties of its new headquarters building at 3628 E. Olympic Blvd., Los Angeles.

One is a pilot plating plant, the other an analytical laboratory, and the two adjoin on the first floor of the new building. The pilot plant occupies a 30' x 30' room and is equipped as a completely operating plating plant. Through it the company offers free service in the form of consultation to the plating and polishing trade.

The laboratory has a complete setup for running test panels and for making other tests to determine the plating characteristics of solutions, based on which tests, plus the company's analysis, plating shop owners can correct their solutions.

The pilot plant is, in fact, a minia-

ture plating shop. It contains 12 tanks ranging in size from 150 to 200 gallons. The tanks include rinse and acid dip vats, high speed copper, bright nickel, Rochelle copper, cadmium and zinc, as well as separate cleaning tanks for steel, zinc and brass, and a number of smaller solution tanks for silver, gold and tin. Various types of tank lining are used. The plating tanks are lined with lead, rubber, black *Koroseal*, white *Koroseal* or *Tygon*. The rinse tank is equipped with a spray plus dam type overflow. Tank heating is accomplished with electric immersion heaters. *Udylite* rectifier, rheostat and plating controls are used.

The pilot plating laboratory has a

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For Fast Metal Polishing



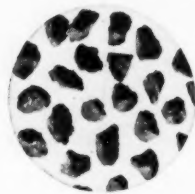
Accurate Grades... Iron Particles Removed

Exolon Aluminum Oxide Abrasives are available for polishing all types of metals.

The special production facilities at the new Exolon plant provide unsurpassed uniformity of grading (size and shape) in all standard sizes; thus assuring fast and satisfying polishing results.

Due to its greater freedom from magnetic particles, Exolon is a more efficient grain for polishing stainless metals... a safer material to use since ferrous materials will not become embedded in the surface.

Write for Exolon's folder on polishing procedures and recommendations.



*Photomicrograph of
Exolon RST Polishing
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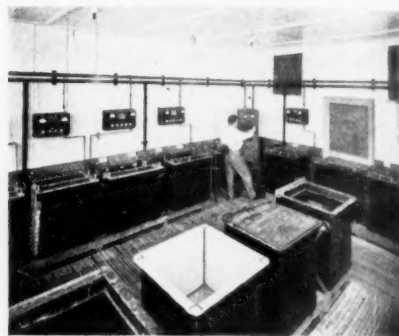
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Manufacturers of SILICON CARBIDE and ALUMINUM OXIDE ABRASIVES

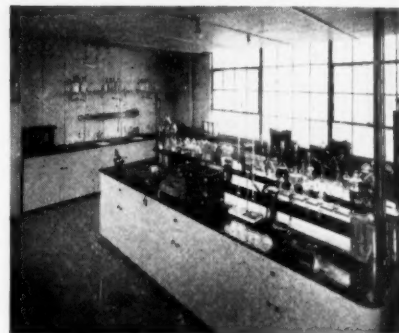
curved floor of concrete with a trench type drain to assure adequate drainage. The concrete is topped with floor boards. Walls, floor and equipment are painted with corrosion resisting paint.

The analytical laboratory occupies a 35' x 35' room. This is a conventionally equipped facility with the customary items for making tests of all kinds in plating and polishing solutions and various kinds of work.

T. Greenman is chief chemist; *Earl W. Arnold*, chief engineer in charge of service. Both function under the general supervision of *Jack A. Raskin*,



View showing the pilot plating plant.



Showing the analysis laboratory.

manager of the firm's plating department.

The company was founded by *L. H. Butcher* in 1890 at San Francisco. The firm was subsequently acquired by *S. L. Schwartz*, now chairman of the board. Other officers are *W. D. Schwartz*, president; *G. B. Brown*, vice president, in charge of the San Francisco branch; *E. F. Clark*, vice president, in charge of Seattle, Wash., branch; *V. M. Schwartz*, secretary; and *J. D. Schwartz*, treasurer.

The Pacific Industrial Conference will be held in San Francisco October 21 to 25, inclusive, concurrently with the 1947 *Pacific Chemical Exposition*. *Dr. R. D. Stewart* of the

University of California, program coordinator for the P.I. Conferences, has announced that any one registering for the conference is invited to attend any and all programs presented by the participating groups.

Collaborating in the conferences are the following groups: American Institute of Chemical Engineers, California Section; American Society for Testing Metals; American Institute of Mining & Metallurgical Engineers; Golden Gate Paint & Varnish Production Club; Northern California Rubber Group; Pacific Insecticide Institute; Institute of Food Technologists; Western Chemical Market Research Group; American Chemical Society, California Section—Analytical Group and Petroleum Group.

Visiting Pacific Coast manufacturers and suppliers of plating materials in August was *H. C. McTaggart*, manager of the Wellington, New Zealand branch of *Rob. Bryce & Co., Pty., Ltd.*, Melbourne, Australia, plating material and chemical suppliers which has branches in Wellington, N. Z., Adelaide and Sydney, Aust., and London, Eng. Mr. McTaggart made a seven weeks business tour of the United States, visiting New York, Chicago, Detroit, St. Louis, Seattle, San Francisco, Los Angeles and other key manufacturing areas. He made the trip from and return to New Zealand by Pan-American Clipper plane.

New West Coast Manager of Tube Turns, Inc.

Jack Green, sales manager of the



Lewis M. Bound, Jr.

Ingenious New Technical Methods

To Help You
Simplify Production



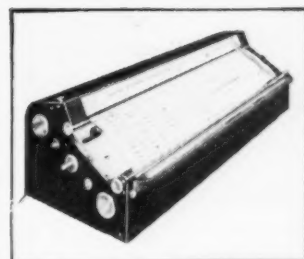
New Automatic Device Provides Up-to-the-Minute Visual Record

The new CHART-O-MATIC provides an instant visual record of all production, shipments, purchases, absenteeism, etc. Avoids inventory surpluses. Guides purchasing department giving constant picture of all parts and supplies on hand. Requisitions can be made direct from chart. Information from all departments transmitted to operator by Telautograph permits instant recording on CHART-O-MATIC. Does away with big wall charts and card-systems and tedious, time-consuming search for data that is often far from current. With the CHART-O-MATIC, the complete activities of the entire plant can be determined in an instant.

The entire unit is easily portable and operates from 110 volts current. Chart rotates in either direction by finger-tip control. Speed may be governed by rheostat.

New devices are proving their worth in saving time and reducing nervous tension on the job. And modern plants throughout America are finding that chewing gum on the job helps relieve monotony and helps to keep workers alert. That is why more plants every day are making Wrigley's Spearmint Gum available to their employees.

Complete details may be obtained from Spiral Mfg. Corporation, 3612 N. Kilbourn Avenue, Chicago 41, Illinois.



The New Chart-O-Matic



Filter All Plating Solutions Faster, More Completely in

SPARKLER Horizontal Plate FILTERS

Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low

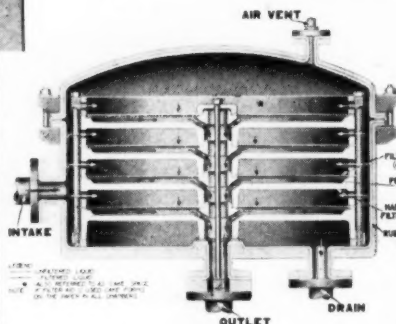
cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
4. All Steel (with Stainless Pump) for chromium

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Our Engineering Service
is available for any
specialized problems.

Welding Fittings Division of Tube Turns, Inc., Louisville, Ky., has announced the appointment of *Lewis M. (Lou) Bound, Jr.*, as west coast manager, with headquarters in San Francisco.

Mr. Bound will assume his new duties on September 1. A native of Independence, Kansas, he attended high school in Braintree, Mass., Thayer Academy, and Purdue University. He joined Tube Turns' New York office sales staff in July 1941. During his three years in the Army, he served in the Field Artillery in the European Theater.

New Plants and Expansions

Opening of new and expansion of existing plating and polishing plants appears to continue unabated in the Los Angeles area. Among some of the summer developments in this field are the following:

Industrial Plating Company, Glendale, has installed \$15,000 worth of new equipment, including a bright nickel setup, copper and a cadmium barrel tank. The firm specializes in the processing of automotive and motorcycle accessories under the direction of *Byron H. Farwell*.

Lockheed Aircraft Corporation,

Burbank, has completed a plating shop addition and outfitted it with approximately \$15,000 worth of new metal finishing facilities engineered by *Cecil Mayo*. The major new items include a bright nickel, chrome and copper installation for use in finishing decorative plane parts, mainly for passenger ships.

Adel Precision Products Company, Burbank, recently completed installation on new equipment for bright nickel and decorative chrome work and an electrolytic polishing setup. The equipment is for use on camera parts and a miscellaneous line of peacetime products.

One of the larger new plating shops is one just opened by *Pacific Air-motive Corporation* in Burbank. The firm acquired one of the wartime production buildings of the adjacent *Lockheed Aircraft Corporation* and has installed an estimated \$75,000 worth of polishing and plating equipment in a shop measuring 100 x 150 feet. The new equipment includes 20 new tanks, each equipped with a rectifier, for use in silver, brass, bright copper, bright nickel, decorative and hard chrome work.

At Van Nuys, *Aviation Maintenance Corporation* has completed installation on \$35,000 worth of new equipment, including a 5,000 ampere generator, and solution tanks for plating iron, silver, rhodium, copper, nickel, chrome and decorative chrome. The major portion of this firm's work is reported to deal with the conversion of government planes and planes for South American air lines.

A new job shop has just been opened at 535 Avenue 20, Los Angeles, under the name of *Verness Metal Finishers*, with *James Houston* as shop foreman. It has been equipped at a cost of approximately \$20,000 with nickel, copper and chrome tank facilities, including one chrome tank 18 feet deep.

Pete Jareke, a World War II veteran, and associates, have opened the *Burbank Plating Company* at 908 San Fernando Road, Burbank, and has equipped it with new bright nickel, chrome and copper tank facilities for finishing metal furniture. The new plant is said to represent an investment of \$15,000.

Another new job shop which was opened for business in Burbank this summer is known as *Sta-Chrome Plat-*

ing Company, operated by Al Clenard. He has equipped it for general job shop work in the field of chrome, nickel and copper plating. His initial equipment includes three solution tanks measuring 8 x 3 x 3 feet and two 7½ lathes.

The new plant of Dibbern's Silver-smiths was officially opened at 213 S. Glendale Ave., Glendale, on August 29 by owner A. H. Dibbern. The plant, representing an investment of some \$40,000, is said to rank as one of the finest silver and precious metal finishing plants on the West Coast. The shop is equipped for specializing in the renewing and preservation of silverware and jewelry. Facilities are available for repairing and replating gold and silver costume jewelry and a wide range of silverware. A special department has been installed for the manufacture of handwrought sterling. Joseph Sunderhaus is superintendent of plating operations.

Adams Rite Manufacturing Company, 540 Chevy Chase Drive, Glendale, recently completed the installation of \$25,000 worth of equipment in its recently completed new plating plant. The new items consist of bright nickel, anodizing, chrome, bronze and copper tanks. The firm handles builders hardware and does anodizing on airplane parts. James Mason is plating shop foreman and Frank G. Fenger, production manager. The shop was laid out and equipped through Andrew J. "Carload Andy" Ospring.

John Merigold, who for many years operated gold and precious metal plating shops in Los Angeles, has come out of retirement—partially, at least, he reports—to engage as a consultant on shop problems and installations. He recently supervised the installation of what is said to be the largest solution tank in the United States for copper plating glass mirrors. The tank measures 8 x 10 x 2 feet and has a capacity of 1600 gallons. It was installed in the plant of Republic Glass Company, Los Angeles.

Square Deal Machinery Company of South Gate, Calif., reports it has acquired the facilities and manufacturing rights of the Mercury Metal Products Company, formerly at 3475 Union Pacific Avenue, Los Angeles, from Joseph Gruell of Long Beach. The Mercury lathe is now being produced in the plant of Square Deal at

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DU-LITE TUMBLING COMPOUNDS



DU-LITE No. 222 is an abrasive-free tumble cleaning agent, designed speedily to remove messy oil films and soil impregnations from metal parts through its powerful, yet harmless detergent action. No. 222 can be used in tumbling barrels with or without steel shot, discs or stone chip fillers.



DU-LITE No. 333, containing selected abrasives, does a quality tumble-deburring operation on metal parts, and produces a velvety smooth finish. No. 333 can be used with or without steel shot, discs, or stone chip fillers. These new products are up to DU-LITE'S famed high standard.

Send for generous experimental samples of these tumbling compounds and the literature describing their unique features.

DU-LITE CHEMICAL CORP.

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3694 Otis Avenue, South Gate, along with that firm's lathe, Phil Greathead, president, reports. Associated in the company with Greathead are Myron Heffer, secretary-treasurer, Roger Dunager and Tim Beadstresser, vice presidents.

George Babst, assistant secretary-manager of the Metal Finishers Association of Southern California, died of a heart attack on September 6. He was assistant to Sol Smith, executive director of the association, the membership of which is composed exclusively of plating job shop owners.

Harold Sheppard, formerly foreman of the plating department of the Repeal Brass Company, Los Angeles,

has been appointed Pacific Coast representative for Lasalco, Inc., St. Louis, Mo., succeeding Frank Rushton, who for some time has been confined with illness in the Sawtelle Military Hospital, Sawtelle, Calif.

Louis G. Shoals, formerly sales engineer with Latex Seamless Products Company, 657 E. 61st St., Los Angeles, is now active in a similar sales capacity with Latex Dipped Products Company, 4620 E. Washington Blvd.

H. P. Chase, vice president and director of sales of Mefford Chemical Company, Los Angeles, announces that the firm has taken on the western distribution of the products of Frederick B. Stevens, Inc., of Detroit, Mich.



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The most complete line of buffing and polishing compositions; tested in the laboratory; proved on the job! If your operation requires a special composition we'll prepare a formula for you. Write for details of the entire Speedie line — today!

SPEEDIE STAINLESS STEEL COMPOSITIONS

Superior and economical materials for buffing and coloring stainless steel.

SPEEDIE CHROME COMPOSITION

Unsurpassed for coloring; will give the highest lustre. Especially adapted to small work, particularly in the jewelry industry.

SPEEDIE LIME COMPOSITIONS

Remarkably efficient compositions for nickel and copper buffing and coloring. Readily washes out.

SPEEDIE TRIPOLI COMPOSITIONS

Extremely dependable buffing compositions for brass, bronze, aluminum and copper work of all types. Tripolis for cut and color.

SPEEDIE EMERY CAKE

Ideal for polishing bumper bars and all types of hardware.

SPEEDIE GREASE STICK

Polishing is quicker, easier when SPEEDIE Grease Stick is used. Especially efficient on aluminum castings.



Bufs, Polishing Wheels, Glue, Cement,
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Hot Dip Tank**
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Reduces labor, saves time, meets all metal cleaning requirements in practically all industries.

Heetmaster Tanks are equipped with removable dipping baskets to hold small parts; also equipped with scum gutter for removal of overflow and lighter-than-water dirt; also a sludge drain for easy removal of heavier-than-water dirt accumulation.

Made in various sizes to fit any requirement. Sold by Magnuson Products Corporation for cleaning operations.

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Business Items

Handy & Harman and Thomas J. Dee & Co. Join Forces

G. H. Niemeyer, president of *Handy & Harman*, Harry E. Radix, president and Thomas G. McMahon, secretary-treasurer of *Thomas J. Dee & Company*, have announced that their two concerns have joined forces. This affiliation brings together two long established successful companies which have had close business relationships for many years.

Handy & Harman (1867) a leading refiner and producer of silver and gold alloys for the Arts and silver brazing alloys and other silver products for Industry has its principal plant in Bridgeport, Conn., a plant in Toronto, Canada, and service plants in New York, Providence and Los Angeles.

Thomas J. Dee & Company (1889) activities include the making of products for the dental profession and trade, jewelry trade and chemical and other industries with its plant in Chicago.

Thomas J. Dee & Company will become the Dee Division of Handy & Harman and will continue to function under Harry E. Radix and Thomas G. McMahon and the present plant executives and personnel. It will maintain the present downtown Chicago office in the Pittsfield Building, 55 E. Washington St. Handy & Harman's Chicago office will move from 20 North Wacker Drive to the Dee Division plant at 1900 W. Kinzie St.

This joining of forces will provide extended local facilities in the Chicago and midwest area for Handy & Harman. The operations of the Dee Division will benefit from the wide experience of Handy & Harman and the added technical and metallurgical facilities of its staff.

Du Pont Announces Chlorinated Solvents Price Increase

The Du Pont Company announced increases of one-half to three-quarters of a cent per pound on its chlorinated solvents — perchlorethylene, trichlorethylene and methylene chloride. The company said the raise in prices reflects directly recent sharp increases in the costs of raw materials and drums.

In Zone 1, trichlorethylene deliv-

ered is now 10¾ cents per pound in less-than-carload lots; 10 cents per pound in carload of drums; and 9½ cents in tank cars, as compared with 10, 9½ and 9 cents.

New perchlorethylene delivered prices are 11½ cents per pound in less-than-carload lots in Zone 1; 10¾ cents per pound in carload of drums; and 10¼ cents per pound in tank cars, as compared with 10¾, 10¼ and 9¾ cents per pound.

American Wheelabrator Appoints Alverson and Uhl

Mr. Troy T. Alverson has been appointed assistant manager of the *Dust and Fume Control Division* of the *American Wheelabrator & Equipment Corporation*, Mishawaka, Ind. Mr. Alverson was formerly a district sales representative for the company with offices in Baltimore, Md.

Prior to his present association, he was assistant to the factory superintendent of the *Glenn L. Martin Company*, Baltimore. During the war he was manager of a naval shell plant. Before this he was president and general manager of *Maryland Sanitary Mfg. Company* and general superintendent of the *Crane Company's*, Chattanooga, Tennessee plant.

Mr. Fred E. Uhl has been appointed district sales representative, succeeding Mr. Alverson, with offices in Baltimore, Md. Mr. Uhl was formerly a sales engineer for *Westinghouse Electric Company*, New York City office.

Pangborn Corp. Announces District Personnel Changes

Victor F. Stine, vice president and sales manager of the *Pangborn Corporation*, manufacturer of blast cleaning and dust control equipment, Hagerstown, Maryland, announces important changes of personnel in the Pittsburgh, Chicago and Pacific Coast districts.

Ralph M. Trent, for 14 years manager of Pittsburgh and Central Pennsylvania district, has been transferred to the Pacific Coast as manager of all Pangborn business on the West Coast. Mr. Trent will assist present Dealers and may be reached at 1400 Old Mill Road, San Marino, Cal.

John D. Wise, former director of purchases of the firm, and district sales representative in the Chicago district since 1945, will succeed Mr. Trent as manager of the Pittsburgh district. Offices will be continued at

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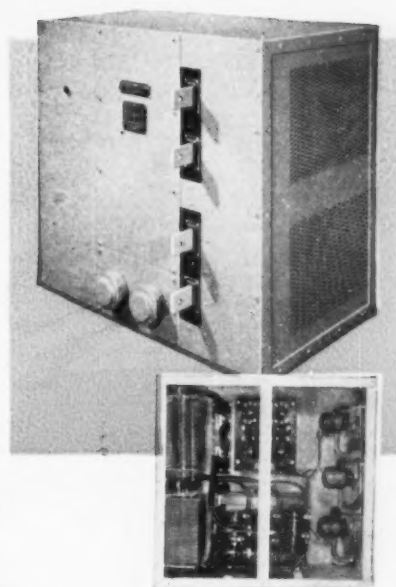
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- SIMPLE SERVICING
- LOW INSTALLATION COST
- LOW OPERATING COST
- LOW MAINTENANCE COST

Selenium-on-aluminum cells handle momentary overloads up to 1000% of normal. Effective rectifying area over 4300 square inches. Three 40-watt fans provide ample low-velocity cooling. Transformer, two winding type, reserve capacity. Welded steel enclosure for vertical stacking if higher power is desired.

Output, 6 v. at 1500 amp., 12 v. at 750 amp., Input, 220/440 v. 60 cycle 3 ph., power drain approximately 12 Kw. at full load. 34" high, 36" long, 22" wide, floor area 5.5 sq. ft. Weight, approximately 500 lbs. Other voltages and current capacities available.



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Buffing and Polishing Compositions Cleaning Compounds

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RADIO CONTROLS INCORPORATED

DESIGNERS AND MANUFACTURERS OF

MODEL RCEP 103

ELECTROPLATING RECTIFIER

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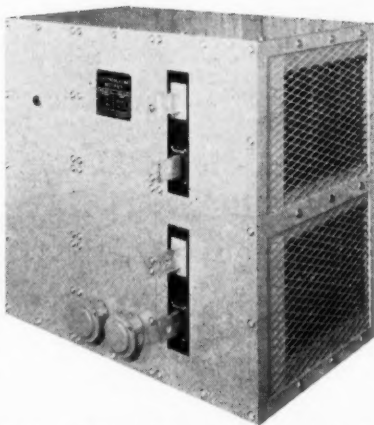
HIGH EFFICIENCY →

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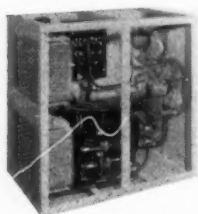
Output: 6 V. at 1500 A.,
12 V. at 750 A. Input: 220
or 440 V. 60 cyc. 3 ph.
Power drain 12 Kw. at full
load. Special selenium cells
insure most efficient dry
plate rectification in use.
Transformer of conserva-
tive design to meet all op-

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fan installation for smooth
penetrating air flow.
Sturdy, electric welded en-
closure. In large installa-
tion units may be ver-
tically stacked to minimize
floor space. Dimensions:
34" high, 36" long, 22" wide.

Floor space required 5.5
square feet. Weight: ap-
prox. 500 lbs. Finished in
smooth surface industrial
gray. Regulating and other
accessory equipment avail-
able. Other voltages and
current capacities can also
be furnished.

Users of our equipment include GENERAL MOTORS—TRUE BRITE CHEMICAL—
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—AUTO-PULSE CORP., and many others.



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Copper Wire

Bare copper wire in coils
or spools in all gauges for
plating use. Prompt ship-
ment. Catalog No. 60 on
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Flexo Wire Company

70 W. FIRST STREET OSWEGO, N. Y.

200 Magee Building, 334 Fourth Ave.,
Pittsburgh, Pennsylvania.

Frank Newell, having completed two
years service in Sales Engineering at
the home office in Hagerstown after
six years field work throughout the
middle west, will be transferred to the
Chicago office as district sales engineer
under the direction of L. W. Wagner,
Chicago district manager. The Chi-
cago headquarters are located at 510
North Dearborn Street, Chicago,
Illinois.

Gordon Spencer Joins George L. Nankervis Co.

Mr. Gordon Spencer has recently
joined the George L. Nankervis Co.



Gordon Spencer

and will open an office for that com-
pany at 303 Patterson Building, Flint
1, Mich. Mr. Spencer will handle the
business of the company in the Sagi-
naw Valley District. He was formerly
chief metallurgist at the Flint Plant of
Chevrolet, and is an active member
of the *American Electroplaters' So-
ciety*.

Pennsalt Reduces Price on Two Metal Cleaners

A reduction of approximately 10
percent in prices of Pennsalt PM-90
and Pennsalt PM-95, effective Septem-
ber 1, was announced at the offices of
the Pennsylvania Salt Manufacturing
Company by George B. Beitzel, vice
president in charge of sales.

Improved manufacturing techniques
and increased sales volume have made
possible the reduction in the prices of
these two specialty acid cleaners, both
of which have found wide use as clean-
ing and descaling agents in metal
working.

Michigan Chrome Appoints Mid-West Sales Representative

King Ruhly has been appointed mid-west representative by Michigan Chrome and Chemical Company, 6340 E. Jefferson Ave., Detroit 7, Mich. Mr. Ruhly will represent the complete line of Micro products, rack coatings, stop-off lacquers and corrosive resistants, for the plating industry, covering Indiana, Illinois, Wisconsin, Missouri, Iowa and Minnesota.

Mr. Ruhly was graduated with honors from Wayne University, Detroit, in 1939. He continued study on



King Ruhly

his master's degree while serving as principal and teacher at Franklin School, Franklin, Mich. Following a brief period in the personnel department with Vicker's, Inc., Detroit, he enlisted in the Navy.

After a year with the Veterans Administration, supervising on-the-job training for disabled veterans, Mr. Ruhly joined the sales staff of Michigan Chrome and Chemical Company, and received a thorough background training in the application of the company's products.

H-VW-M Adds to Staff

The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces the appointment of Walter A. Cary to their sales and service staff.

Mr. Cary is a graduate of Fordham University with the degree of B. Sc. in chemistry and has had wide experience in the plating industry. He has taken an extensive training course at the Matawan plant and has now been assigned to the field in the New York State territory.

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and over a hundred years of technical background, Mutual is the world's foremost manufacturer of Chromic Acid.



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FOR FASTER CUTTING . . . INCREASED
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Uniform, quality compounds for

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• Our Stainless Steel Polishing

Compounds are giving satisfaction to many of the country's leading companies. Quality is maintained at all times, so that you can order with confidence.

Write us at any time in regard to special problems. We will be glad to advise you and send samples of compounds that will meet your special needs.

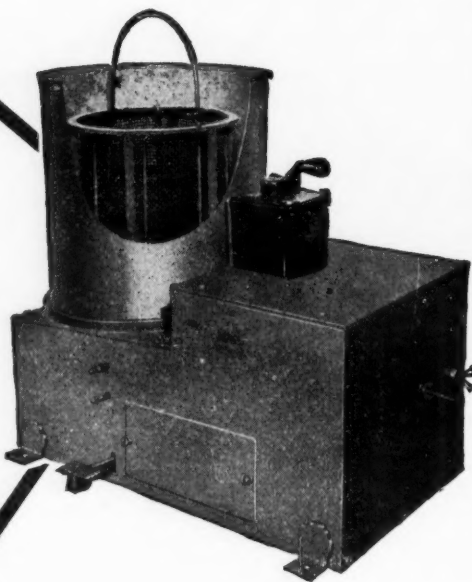
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Compounds in
Sizes — 150—
180—220—240
& 320

HARRISON & COMPANY, INC.

HAVERHILL, MASSACHUSETTS

High Speed Drying

Eliminate profit-consuming production lags with the modern, speedy Kreider Centrifugal dryer. This economical and efficient dryer is engineered for one-man operation and dries a basketful of small parts in only 35 seconds. V-belt drive. $\frac{3}{4}$ H.P. motor. Available with or without auxiliary heating unit.



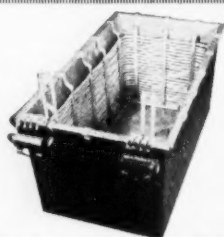
Cuts Costs



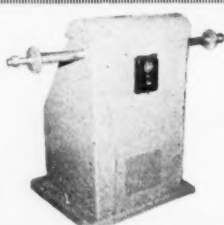
Send for FREE illustrated bulletin giving complete specifications and showing applications of the Kreider Dryer in modern manufacturing plants.

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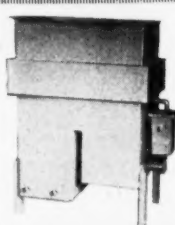
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Wyandotte Chemicals Adds to Cleveland-Chicago Service Forces

Stephen O. Johnson and Robert K. Tucker are new additions to Wyandotte Chemicals Industrial Department



Stephen O. Johnson

service forces in the company's Cleveland and Chicago territories.

Both new Wyandotte representatives were given intensive training by the Technical Service Department at the home office laboratories at Wyandotte, Michigan and refresher courses in several sales territories. Mr. Johnson studied at University of Michigan and graduated as a chemical engineer from Tri-State College of Indiana. He joined the Wyandotte Chemicals Research Department early in 1942. At the close of the war activities he was assigned to the Inorganic Section of the department and assisted in the preliminary studies which led to the



Robert K. Tucker

development of Zorball—the new all-purpose floor absorbent.

Mr. Tucker is a graduate in chemistry from Albion College of Michigan. He completed his studies following 3½ years in the U. S. Army which finally lead to occupation duty in Tokyo. He joined the firm in February of this year.

Klem Chemicals Announces Expansion Plans

The recently announced incorporation of the *Klem Chemical Works* with a new name, *Klem Chemicals Incorporated*, is the first step in expansion plans necessary to take care of increased demands for their chemicals and industrial cleaners, states *T. Curtis McKenzie*, president of the organization. Plant expansion is already underway and when completed will



T. Curtis McKenzie

provide more than double the present manufacturing capacity as well as faster and more efficient delivery, Mr. McKenzie further stated.

General offices of the company will remain at the plant located at 14401 Lanson Ave., Dearborn, Mich. Sales offices and warehouse stocks are now maintained in many of the principal cities of the east and middle west. Expansion plans call for additional offices in practically all major manufacturing centers of the nation. Representatives are now being sought to handle the new territories.

New Home of Bart-Messing Corp.

The new house of the *Bart-Messing Corporation*, manufacturers of the *Sel-Rex Selenium Rectifiers*, is a modern

BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ...AN IDEAL BASE FOR CHROMIUM



NEW IMPROVED *Lustrebright* Bright Nickel Process

Produces Brilliant, Lustrous, Adherent Nickel Deposits •
Eliminates Color Buffing — Re-Cleaning — Re-Racking • An
Ideal Base for Chromium • Excellent Throwing Power •
No Special Solutions or Changes in Equipment Required •
Easy to Control • Low in Cost • Successful • Practical.

Gives uniform results and continuous operation on all classes of work in still tanks and mechanical barrels. Substantially reduces plating costs. Brilliant, lustrous, nickel deposits that may be chromium plated, are produced by merely adding NEW IMPROVED LUSTRE-BRIGHT to your present cold nickel solution, if of standard formula.

Work comes from plating tanks with bright, fine grained, adherent deposits. No color buffing or burnishing is required. Work may

be transferred direct from nickel to chromium bath, without intermediary buffing, re-cleaning, or re-racking. Excellent for zinc die-castings.

GUARANTEED NOT TO HARM PLATING SOLUTION. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of NEW IMPROVED LUSTREBRIGHT. Write for complete information.

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building located at 45 Morgan Ave., Brooklyn, N. Y.

The most advanced scientific developments and testing paraphernalia have been installed, including a 400 ampere power line capable of testing 10,000 ampere rectifiers at full load, accord-

ing to Mr. M. Messing, president of the firm. He also states that all rectifiers shipped must produce in their entirety all the ratings claimed for Sel-Rex Selenium Rectifiers. To check every unit the following instruments are used: cathode ray oscillographs, indus-

trial analyzers, resistive load instruments for testing up to 10,000 amps, ultra-sensitive *Celectray* temperature indicating meters for accurately recording temperature rise, *Weston* volt and ammeters accurate to $\frac{1}{2}$ of 1% and *Weston* industrial circuit testers.

The total space is in excess of 6,000 square feet. The factory occupies the entire first floor and the executive offices on the second floor. The laboratory for testing chemicals, metals and plating processes, remains in Belleville, N. J.,

Samuel Spring Joins Pennsalt Research & Development Division

Samuel Spring, formerly a research specialist for the Federal Government, has been appointed to the Research and Development staff of the *Pennsylvania Salt Manufacturing Company*. He will have charge of the inorganic research group at Pennsalt's White-marsh Research Laboratories.

Mr. Spring, a native of New York City and a graduate of the College of the City of New York, received his master's degree at Columbia University. For two years he served on the



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DYESTUFFS and CHEMICALS necessary for Anodizing and Dyeing Aluminum now available.

Seal your Dyed Aluminum with Alrez.

A well equipped laboratory with staff of electro-chemists and colorists to serve you. *Circular of information with price list and samples on request.*

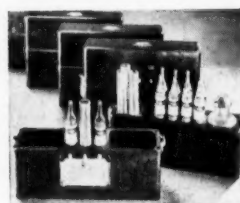
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Established 1838—Over One Hundred Years

LaMotte Plating Control Equipment



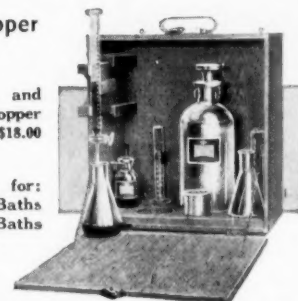
The active acidity and alkalinity of electroplating and electrolytic baths (*) for the uniform deposition of metal are now universally controlled by the pH method. LaMotte Block Comparators are standard equipment in this field. They are also required for careful pH control of Metal Cleaning Solutions(*). Price each \$12.50 f.o.b. Towson, Md.

The LaMotte Acid-Copper Analytical Set

For accurately determining and regulating both the acid and copper content of the bath. Price \$18.00 f.o.b. Towson, Md.

Similar units also supplied for: Nickel content of Plating Baths Control of Chlorides in Plating Baths Nickel-Chloride Control in single unit.

(Prices upon request)



The LaMotte Plating Control Unit, Model U7

This LaMotte Outfit provides for the control of Acid Copper, Cyanide Copper, Acid Zinc, Cyanide Zinc, Cadmium, Brass and Bronze Plating solutions.

Complete with instructions \$50.00 f.o.b. Towson, Md. Additional equipment for analysis and control of silver baths can be added to the above unit at a cost of \$5.00.

(*) Reports on various Plating Control Processes are available without obligation. Write for them.

If you do not have the LaMotte "ABC of pH Control," a complimentary copy will be sent without obligation.

LaMotte Chemical Products Company
DEPT. "MF" TOWSON, BALTIMORE 4, MD.

faculty of City College of New York and later became associated with Frankford Arsenal where he supervised research on metal cleaners and metal-working lubricants for the last seven years. He is a member of the American Chemical Society and of Phi Beta Kappa.

Spray-Coat Engineers Become Amercoat Michigan Representatives

Spray-Coat Engineers, Inc., announce that they have been appointed Michigan representatives for the *Amercoat Plastic Coating Division* of the *American Pipe and Construction Company*.

The firm has just finished two entire electroplating plants with plastic coatings. The floors, drainways, tank linings, exterior of the service equipment, ducts and walls were all coated with plastic materials.

Mr. J. H. Lo Prete, formerly chief chemist with the *Wolverine Tube Division* of the *Calumet and Hecla Copper Company* is the president and supervisor of the tank lining problems.

Spray-Coat Engineers also an-

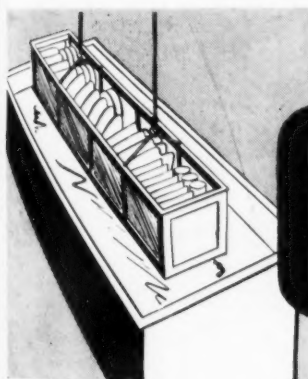
nounce the new plant location at 8711 W. Chicago Blvd., Detroit. Their new plant will be equipped to do the entire line of plastic coating. The spray

asphalt division will also be transferred from the Shaeffer Highway yard to the West Chicago Blvd. address.

New Warehouse for H-VW-M

The *Hanson-Van Winkle-Munning Company*, of Matawan, N. J., announces the completion of a new Stratford, Conn. office and warehouse at 382 Seymour Street, Stratford, Conn. This building is a steel, con-

crete and brick structure of modern construction, one and two stories in height with a total floor space of 6640 square feet. Its purpose is to provide a stock of electroplating and polishing supplies and equipment for quick



**Prevent Waste —
PROTECT
PARTS**

Iron and steel castings, parts, machined surfaces, can be protected from rust by a simple, quick cold immersion in Kelite Process K (patented). Parts which have been damaged by weathering can also be quickly restored by immersion in Kelite Scale-Off at room temperature.

This simple processing is an example of the development work done on all Kelite chemicals for metal finishing. Write Kelite Products, Inc., Box 2917, Terminal Annex, Los Angeles 54, Calif. for bulletin, free samples, or free demonstration of Process K and Scale-Off.

*Industrial Chemicals for Cleaning and Processing
Manufacturing Plants in Los Angeles, Chicago, Dallas,
Australia. Offices in principal cities.*



**STANTON
CEMENT**
for
FLEXIBILITY

ONE grade grips
ALL grains!

Ready-to-use Cold Cement for Setting-up Polishing Wheels — Belts — Discs

FOR flexibility use STANTON! One grade grips all grains! (from grade 60 to grade 320). For use on polishing wheels, belts and discs, for polishing all metals.

Packed in the following size units:
1 quart; 1 and 5 gallons; 30 and 55 gallons.

DISTRIBUTORS WANTED: Jobbers, attention! Special proposition to live wire outlets. Liberal allowance on quantity purchases. Wide margin, quick profits, fast turnover. Request details.

Prompt Shipment in Any Quantity

Stanton PRODUCTS COMPANY
2055 W. LAKE STREET
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service and delivery to customers in New England.

Offices have been provided in this building for the company's Connecticut representatives, *George G. Knecht* and *Robert E. Creamer* and for *Walter J. Jurman*, warehouse manager.

Cowles Detergent Co. Conducts Metal Cleaning Clinic

The Cowles Detergent Company has been conducting a series of Salesmen's Clinics for Cowles technical men at the home offices and laboratories in Cleveland, Ohio. One of the groups comprising men in the Metal Cleaning Division is shown.

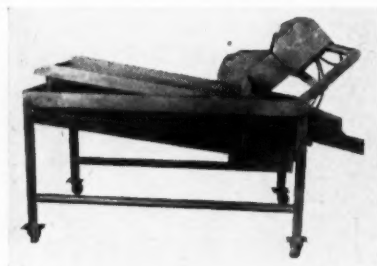
Standing from left to right are *Clarence Ozar*, manager of the Metal Cleaner Service Laboratory; *Clyde Lowe*, Cowles technical man; *C. C. Bassett*, vice-president & director of sales of the company; Cowles technical man *Gene Garman*; *E. F. Clark*, manager of Cowles' Metal Cleaner Department; and Cowles technical men *Charles Churchill*, and *Harold Fulton*. Seated are CTM *Jack Dobson*; *M. P. Boland* of the Metal Cleaner Research



Staff; and CTM *F. H. Hitchcock*. Dr. *C. W. MacMullen*, the company's technical director also attended the clinic.

The clinic concluded the company's post-war refresher program for all members of the Metal Cleaner Depart-

ment. All phases of metal finishing and cleaning were covered in detail and each Cowles representative returns to his territory well equipped to handle current problems in this ever changing field.



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For all types of

SCREENING PROBLEMS

Quick - Efficient - Economical

Interchangeable Screens - Fractional Horsepower Drive
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Consistently excellent buffs and wheels are the outgrowth of our 37 years' experience. Since 1910 we have been supplying buffs and wheels of every description to industry. Your inquiries are invited.

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Michigan Buff Company Moves to New Larger Plant

Mr. A. W. Payson, president of the Michigan Buff Company, Inc., announces the change in address of his firm from 4054 Beaufait Ave., Detroit, to its new modern building, which is completely air conditioned, at 3503 Gaylord Ave., Detroit 12, Mich.

Having been in business since 1929, the firm handles new and used buffs, polishing wheels, polishing equipment and are jobbers and distributors for many of the large manufacturers of polishing and buffing supplies and equipment. In addition, the company handles abrasives of all descriptions, buffing compounds, glues and all other items pertaining to abrasive surface finishing.

The company also operates an office and warehouse in Chicago, Ill.

H-VW-M Field Force Changes

The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces the following changes in their field force:

Arthur C. Pearson transferred from the Philadelphia office to New England, where he is associated with Frank J. Clark in covering Massachusetts and nearby territory.

Howard L. Wright transferred from the New York State territory to Philadelphia.

NEW BOOKS

Electro-Plating, by Samuel Field and A. Dudley Weill, Pitman Publishing Corp., 483 pages, price \$5.50.

This in an enlarged edition by two of England's better known authors of the previous book which was published before the last war. The book is of value to the practical plater in that processes are described from a practical rather than a theoretical viewpoint.

Advances of metallic surface treatments in recent years are reviewed and the new methods developed during the war are considered in the light of their influence on future industry.

A feature of the book is the detailed presentation of methods of analysis for controlling various baths. Mechanical and chemical cleaning of metals for plating are covered as is the coloring of metals. A chapter

REBUILT ELECTROPLATING AND POLISHING EQUIPMENT ATTRACTIVE PRICES

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- 1—Dbl. No. 2 Baird Horizontal, Belt drive, new linings.
- 1—Single No. 2 Baird Horizontal, Belt drive, new linings.
- 1—Single No. 1 Baird Horizontal Belt drive, new linings.
- 1—24x8 Single Abbott Horizontal, Belt drive, new linings.
- 1—24x8 Single Globe Horizontal, motorized: 220/3/60: lined.
- 1—24x8 Dbl. Abbott Horizontal, Belt drive, new linings.
- 1—30x8 Single Abbott Horizontal, Belt drive, new linings.

TUMBLING BARRELS:

- 1—Dbl. No. 2 Baird Oblique Tilting, Belt driven.
- 2—Single No. 1 Baird Oblique Tilting, Belt driven.
- 2—Single No. 2 Baird Oblique Tilting, Belt driven.
- 1—Globe No. 2 Oblique Tilting, motorized: 220/3/60.

BUFFERS:

Large selection pedestal type, motor-in-base, and motor-in-head.

BLOWERS AND VENTILATORS:

For Plating and Polishing Rooms. All sizes in stock.

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McKeon's
"Liquid Sulphur"
TRADE MARK REG'D

"Strips
copper
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Strips Evenly
No Possibility of Etch
No Hydrogen Embrittlement

DIRECTIONS:
Immerse work in 66% solution
160° - 180° F. Rinse. Followed
by dip in cyanide. (If cyanide
undesirable, write for special
sulphide diluent).

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PLATING RACKS by JOSEPH NOVITSKY

- We specialize in plating racks of our own patent.
- Constructed without screws, rivets, solder, brazing, welding.
- We design racks to suit your individual problem.

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each is devoted to the electroplating of acid copper, cyanide copper, silver, gold, nickel (2 chapters), zinc, cadmium, chromium, other metals, and deposition of alloys. Processes allied to electroplating are also described, with the viewpoint maintained that the reader is a practical man not too versed in theory.

A comprehensive chapter on the electroplating plant gives an over-all picture of the equipment and supplies required for the average finishing shop. The usual chapters on the chemistry, metallurgy and electrochemical fundamentals are included.

Handbook of Industrial Electroplating, by E. A. Ollard and E. B. Smith, published by *The Louis Cassier Company, Ltd.*, London, England

This handbook is a composite of information on electroplating gathered

largely from the current literature and designed according to the authors, to supplement general information on setting-up and operating a plating plant. All theory has been omitted, making for a compilation of practical information.

The book is divided into eight parts: (1) Electrical Equipment; (2) Deposition Plant; (3) Solution Formulae; (4) Special Formulae; (5) Testing Depositing Solutions; (6) Testing Deposits; (7) Glossary; (8) Miscellaneous and Tables.

In the first chapter, the authors use considerable space in describing electrical equipment required for the plating room; much of the information belongs in the realm of electrical engineering. The second chapter describes vats (tanks) for plating, swill (rinse) vats, degreasers, pumps, filters, heaters and other accessory equipment; while barrel plating and tumbling equipment is described, no mention is made of polishing and buffing equipment and techniques. The next chapter, that of Solution Formulae, gives some formulas on alkaline cleaning and pickling; the balance of the chapter containing the standard formulas for plating the various metals with short explanatory notes on each. The short chapter on Special Formulae covers non-conductor plating, stop-off materials, notes on non-adhesive deposits for electroforming, dyes for

anodized coatings and one formula on coating with platinum black.

The fifth part, that on Testing Depositing Solutions, contains the usual analysis methods for control of the various plating baths. Testing Deposits gives formulas and equipment required for deposit identification, thickness, adhesion, porosity, alloy, salt spray and tropical testing; this seems to be the best chapter in the book.

The Glossary and the final chapter, Miscellaneous and Tables, are quite complete; the former, in addition to definitions of common terms used in England, gives the names of chemicals in common and commercial usage; the latter contains complete tables for use in the plating plant, technical societies, books, periodicals, etc.

In general, the handbook is well arranged, and aside from some minor confusion of the English terms to the American reader, gives a solid assembly of plating plant facts.

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NICKEL ANODES
CHEMICALS AND GENERAL
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Provide Better Chrome Plating Faster at Lower Cost. The Greater Throwing Power of 71 Edges and the Large Surface Area give efficiency never before possible. *Send for Bulletin.*
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The *Institute of Electrochemistry and Metallurgy*, 59-61 East Fourth Street, New York City, offers specialized courses in the field of electroplating and metallurgy during 1947-48. Advancements made in the metal finishing field during the war years are

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FOR NICKEL PLATING

The one bath especially designed for plating diecastings made of WHITE METAL ALLOYS including ZINC, LEAD, and ALUMINUM.

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Finer-grained deposits.
Increased throwing power.
Less sensitivity to sulfate content.

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GUARANTEED
STEEL BALLS
Best for Burnishing . . . Perfect
for Polishing. No culls, no cracks.
Mixtures as Required
THE HARTFORD STEEL BALL CO.
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Fall Courses

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The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analysis. One hour each evening will be devoted to class lectures in which will be discussed the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday and Wednesday from 7:30 to 11:00 P. M. Dr. Young, Mr. Klinse and Mr. Bundy. Fee, \$55.00.

Metallurgy I.

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and testing of metals and alloys will be studied. Tuesday and Wednesday, 8:30 to 9:30 P. M. Dr. Young and Mr. Klinse and Mr. Bundy. Fee, \$40.00.

Research I.

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One-half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to the solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00 to 11:00 P. M. Dr. Young. Fee, \$40.00.

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